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The Engineering and Mining Journal

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American Institute of Mining Engineers

The report of the committee that has been looking into the affairs of the American Institute of Mining Engineers is too lengthy for us to reproduce it in full, but the summary that we give elsewhere will be sufficient. It will be useful to review the circumstances under which this committee was appointed. About the beginning of the year the administration of the Institute proposed an increase of dues from $10 to $15 and some other innovations to be acted upon by the membership at the annual meeting in February. This was opposed by 20 prominent members of the Institute, who inaugurated a movement against the plan of the administration, especially against the proposed increase of dues until an investigation of the affairs of the Institute be made and the determination that there be no other alternative. By virtue of proxies received, the "insurgents" came into control of the annual meeting and carried out their program, holding up the proposed amendments to the constitution and appointing a committee of investigation. All of this was done in a conservative and temperate manner, and the committee appointed, consisting of C. R. Corning, chairman, A. R. Ledoux, Wm. H. Nichols, Jr., J. F. Kemp, and Geo. C. Stone, was unanimously approved.

The committee finds that the Institute has been running behind about $2000 a year in ordinary income, and $7884 more if its share of the land occupied be paid for in equal annual instalments plus interest. The management of the Institute has been imperfect, from a business standpoint, although probably no more so than in the cases of similar organizations, and certainly there was great improvement under Mr. Kirchhoff. The committee is of the opinion that material savings in publishing, in office work, in excursion expenses and in salaries can be effected, and recommends a negative vote upon the amendment authorizing an increase in dues, thus sustaining the position of the "insurgents" last February.

The tone of the committee's report is judicial and its phraseology is temperate. It is a report that is constructive, not destructive, and it is distinguished by the absence of captious criticism. We find in it but one suggestion to which we take any serious exception, viz., "that the appropriation for the retired secretary be, if possible, entirely eliminated or at least very greatly reduced in order to avoid further continuance of the annual deficit." We consider that Dr. Raymond devoted the major portion of his life to the building of the Institute. He more than anybody else established its prestige. Such service would be recognized in any commercial business of ordinary high tone by a retiring allowance adequate to make things easy during the declining years. If the membership of the Institute refuse to recognize such an obligation we shall regard their action as preposterous and indecent. We do not advocate an extravagant honorarium, but to dispense with it entirely is an economy a body of gentlemen cannot consider.

During the investigations by the committee frequent conferences have been held with the board of directors, and the latter, informally advised respecting the findings, have already put into effect some of the economies that are now recommended. Whether these and others remaining to be done will put the Institute in a comfortable financial position remains to be seen. The great difficulty pertains to the indebtedness of about $74,000 still owed on the land upon which the engineering building stands. It goes without saying that this must and will be settled, but the sooner it is done the better it will be. Any further attempt to raise the money needed through a begging committee, appealing to corporations and capitalists, will in our opinion be objectionable. The membership of the Institute incurred the indebtedness by a deliberate vote, and the membership

ought to face the music and pay it. If this cannot be done in any other way the recommendation of the committee that the dues be raised by $5 per year for a sufficient time to liquidate the debt, then automatically dropping back to the old figure, ought to be adopted. We do not think that the insurgents will object to that.

The committee has not dwelled, we think, upon some of the fundamental features of the Institute, probably for the reason that it did not consider itself to be commissioned to do that. We believe, however, that at the forthcoming meeting of the members the problem should be considered in its broadest aspects, and in the meanwhile the council and directors should cast their thoughts that way. The opposition to the proposed increase in dues was based, we think, upon the feeling that the Institute failed to give a proper return even for the present dues. The organization possesses a valuable name, history and prestige, but membership in it has become so promiscuous that no value is attached to that, and about all the benefit to the majority of members has been the receipt of an annual volume of transactions, the need for which is now very much less than it was in the days when the technical press was young and inefficient. The object of the Institute should be to make itself a live and useful thing to its members, to shed some of its prestige among them, to be a means of reflecting their opinions and to be a medium of exchange of experience. A part of this has no doubt been recognized in the reforms instituted during 1911, by the organization of local sections among other things, but however progressive these may have been the inspiration of an important movement does not yet seem to have come.

We have no doubt that the old abuses of junketing excursions and local meetings, the latter throwing improper burdens upon a few members who have to provide entertainment for an indiscriminate assembly of visitors, are going to be summarily abolished. We believe that the dual control of the Institute by a council and a board of directors ought also to be abolished, in favor of one or the other, no matter which. And we think that the Institute has got to make of itself something more than a mere purveyor of miscellaneous technical literature. This is what really ought to be considered during the period remaining before the next meeting of the members.

The Break in Copper

The exponents of the copper boom are beginning to draw the distinction between "real" copper and "unreal" copper that engages their fancy when the tide turns against their wishes. The copper which certain producers are willing to sell at 17¾c., delivered to buyers' warehouses, with the usual allowances, etc., but don't sell because there are not any buyers at that price, is "real" copper. The copper that other producers, and also "second hands," are willing to sell at the market in order to convert it into money, and do sell, is "unreal" copper. "Second hands" comprise professional speculators, casual speculators, and persons who have bought copper for their own uses but for one reason or another may see fit to resell it.

The series of sensational breaks in the London market during the last fortnight indicate that some important persons have made up their minds that the increase in the smelters' production that so mysteriously disappeared—lost, strayed or stolen—is soon going to be found. The optimistic interviews with which the daily and financial press is now so profusely favored, do not necessarily reflect real opinions.

The statistics of the American refiners for June, published on July 9, do not throw much light on the situation, owing to the interference of strikes, etc. What they show chiefly is that the increase in production, already long overdue, has been still further delayed.

Mine Accounting

The art of mine accounting seems to be peculiarly like the old verses

> 'Tis with our judgments as our watches, none
> Go just alike, yet each believes his own.

From descriptions received, and mines visited it appears that each mine has its own system, and that each system is the sovereign panacea for every other miner's accounting ills. The last may be somewhat open to question. Accounting in its ultimate analysis is a system of seeing that one doesn't get stuck by the other fellow, and of knowing whether one is coming or going on one's own operations. Consequently while the underlying safeguards must be the same, it seems that each plant should work out a system with some reasonable divergences to suit its own necessities.

This is not always practical by large corporations running many properties, where uniform accounting often develops into a managerial obsession, but as is occasionally pointed out, it is doubtless also often owing to the topheaviness of the big corporation, that the smaller has any chance. Consequently it is possible that uniform accounting for dissimilar conditions in the big corporation doesn't indicate anything in particular except its undesirability. Hence, we advise to make sure of the underlying soundness of a system, and then adapt it to your own needs.

Preparing Furnace Charges

In most metallurgical operations improvement is experienced when the material to be treated is of uniform character, and this is particularly true of charges for smelting. The zinc smelter, who has to conduct a singularly delicate operation, learned this by experience long ago, but lately the copper and lead smelters have been learning it also.

In the early days, indeed, some care had to be taken in the preparation of charges, because otherwise the small furnaces of that time would freeze up, and do so almost before anyone became aware that anything was going wrong; but with the large furnaces of a later era, there would always be an active smelting chimney affording an opportunity to work out the accretions that had been building up. These large furnaces are veritable firepots into which almost anything can be dumped and smelted down; and so we have come more or less to expecting them to do just that, forgetting perhaps the metallurgical reactions that are to be effected in them.

There are several modern works, however, whereat careful compounding of the charge and insuring of a uniform admixture of the components, together with preparation in the proper physical condition, have resulted in such great increase in furnace efficiency, i.e., the quantity of charge smelted per square foot of hearth area, that there can be no longer any doubt that the tendency of modern smelting practice will be in this direction.

By the Way

A dispatch announces that Page and Pickens won the drilling contest at Tonopah, on July 5, by drilling 45 7/16 in. into a granite block in 15 min., this being 4 in. farther than their nearest competitors, Lundquist and Dahlen, of Victor, Colo.

The daily press has booked a large order for Alaskan volcanos in the following dispatch: "Permanent alteration in the climate of the Alaskan coast, through the shifting of warm ocean currents by lifting of the sea bottom, the opening of new fishing banks, of unestimated value and the eventual closing of Bering Straits, owing also to a rise in the floor of the sea, are among the scientific problems now being investigated as the result of the eruption of Mount Katmai a month ago. So far as the earth's surface is concerned, the eruption was beneficial, the volcanic ash having already stimulated plant growth."

But for the distractions of politics, the obstetrical observations of Daniel Guggenheim, on sailing for Europe, would doubtless have received the attention they deserve, remarks the *Evening Post*. "We have now, as I see it, prenatal prosperity," he said, in his annual interview, "which, if allowed to be born, will, I believe, grow into the greatest this country has ever experienced." Alas! he fears it will not get born (mark the consequences), and that, if born, it will never grow to regular size, owing to the manner in which capital, which is the sire of prosperity, is continually antagonized. However, there are now four shares of Guggenheim Exploration Co. stock where there was but one before, and the four shares of $25 each are selling in the aggregate for more than the one of $100 par value ever was believed to be worth. That is doubtless the strongest possible tribute to the importance of pre-natal influences upon even such things as securities.

Sherman-law dissolutions do not seem to have had serious results to stockholders in the dissolved companies. Standard Oil shareholders are receiving larger dividends than before the dissolution. In the case of the E. I. duPont de Nemours Powder Co., it is announced that the owners of common shares are to receive a stock and bond dividend of $15,000,000, equivalent to 50.9%, when the "trust" splits itself into three parts and distributes the various plants to the three companies. The decree stated that the securities of the new companies were to be distributed to "stockholders" but Pres. Pierre S. du Pont says that the owners of common stock will be the beneficiaries of the dissolution, as the charter of the company specifically states that the preferred stock is entitled to no additional dividend beyond the regular 5%. It is not known whether all preferred shareholders will concur in this interpretation of the provision, under the present extraordinary circumstances.

Though the unexpected and sharp break in the price of copper metal abroad last week was convincingly ascribed to a bear crowd, and though everybody was temporarily reassured, the market has not recovered from the shock of the discovery that there were two sides to the metal market, said the *Evening Post* last week. The price, even if by accident, could go down a little. The tendency of metal prices since has been to sag, and today both Amalgamated Copper and Rio Tinto shares sold lower than on the day the bear party attacked the metal market in London and broke the price ½c. per pound. So much has been staked upon the scheme of copper-metal valorization, that if anything should happen to it, the consequences might not be limited to copper, the metal, and shares. Thus, it is with a feeling of uneasiness that Wall Street reads of metal sales having abated, the prices being for the present nominal, and of the big sellers' unabated expectations. A bullish commentator in Boston has made the mistake of comparing the situation with what it was at the beginning of 1907, when there was not enough copper metal to go around, and copper shares were scheduled to have a great rise, presumably on the theory that if consumers could not procure the metal they would buy the shares.

The glad tidings will, no doubt, reach many hayseeds that their clay banks are going to become valuable as sources of aluminum, when they read the prospectus of the Alumina Oxide Manufacturing & Mining Co., of Los Angeles, Cal. This cheerful concern, which is offering some of its 200,000 shares of stock at $1 per share (it was 50c. before May 1), presents some chemical remarks that make us dizzy, so for stability of thought we seize upon the promise that the first unit of the milling and extraction plant, to cost from $50,000 to $75,000, to handle 100 tons per day and extract 200 lb. of aluminum per ton of ore, is going to produce the aforesaid aluminum at "under 7c. per lb." Ten tons of aluminum per day is 3500 tons per annum. Figure out the profit for yourself. We have never heard that aluminum can be produced even in Europe at under 12c. per lb., and the Southern Aluminum Co., which is about to erect a plant at Whitney, N. C., is contemplating putting $8,000,000 into the business. It seems to us that it will be a shameful waste of money to spend all that for what may be done for a few paltry thousands, according to the Alumina Oxide Manufacturing & Mining Co. We hope that this information will come to the attention of L'Aluminium Française and Dr. Heroult.

The "Corozal," the largest ladder dredge in the world, operating on the Panama Canal, broke the main driving-wheel gear on the port side on June 4, putting the dredge out of commission until a new gear can be installed. The accident occurred while the dredge was excavating in a 25-ft. bank, the upper part of which consisted of stratified clay, and the lower part of argillaceous sandstone, and resulted in breaking off every one of the spokes of the port-gear wheel, leaving the hub entirely free. The gears are 14½ ft. in diameter, 2 ft. wide, and made in two sections, an outer wheel or cog rim, and an inner wheel, consisting of rim, spokes and hub, each section weighing approximately 10 tons. Considerable difficulty was experienced in handling the broken parts, owing to their great weights. A new casting was made at the Gorgona shops, machined at Empire, and was ready for shipment on June 17. Another casting has also been ordered from the Scotch builders, William Simon & Co., of Renfrew. This dredge, it will be remembered, is provided with two sets of buckets, one with buckets of 52 cu.ft. capacity, and the other set with buckets of 34 cu.ft. each. The dredge discharges into barges alongside and was built to dig to a depth of 55 ft. and to have a capacity of 1200 cu.yd. per hour.

Brokers who buy stock on margin for customers must keep the stock constantly in their possession in order that it may be delivered immediately upon the payment by the customer of the amount due, according to a ruling by the Apellate Division of the Supreme Court of New York, on June 27. The court reversed a judgment in favor of the firm of Charles A. Stoneham & Co., curb brokers, in a suit by Pierre A. Shiel to recover $410 as the value of certain curb stock purchased for him which the brokers couldn't deliver when Shiel offered to pay the amount due. The brokers offered testimony to show that the stock had really been purchased for Shiel on the date named, but that when he demanded the stock the brokers had to wait until it could be sent here from Salt Lake City or Toronto. Justice Lehman, who wrote the opinion, said:

> A broker is merely employed to buy stock for his client, and moneys paid to him on account of the purchase price are paid merely as the agent. If he fails to purchase the stock when ordered, hoping to buy the stock at a lower price and pocket the difference, he has concededly converted his client's money; if he does purchase the stock when ordered, but treats the stock as his own, parting with the stock so he cannot deliver it on demand, it seems to me that he has also failed to obey the directions to buy the stock for the client and has also converted the client's money.

Shiel contended that there was no proof that the brokers ever bought the stock at all.

American Institute of Mining Engineers

The report of the committee of five appointed to examine into the affairs of the American Institute of Mining Engineers will be mailed to members the last of this week. The report is too voluminous to reprint in full, but a summary of the conclusions of the committee has been communicated to us and is reprinted below:

SUMMARY

(1) The Institute has been running behind $2000 a year in ordinary net income, and $7884 more if the land should be paid for in equal annual installments plus interest.

(2) Prior to this year, the technical, social, and business affairs have been practically under a one-man management. This is generally undesirable and has become impossible in a society of our present size and diversified activities and should be changed.

(3) The publications have been admirable and of high standing and we would deprecate any change in type, printing, paper, or other literary characteristics, and we suggest that each year in the year book or other prominent part of the publications all three fundamental documents underlying the Institute be published—not only, as heretofore, the constitution and the by-laws, but the certificate of incorporation as well: but we believe that the cost can be materially reduced by reductions and adjustments, even in addition to those which the directors and council have inaugurated in 1912, so that a saving of over $5000 can be effected in this line.

(4) We have indicated in the body of the report other savings in expense through greater efficiency, prompt adherence to office hours, and otherwise.

(5) On page 11 of the report, the committee has given in detail its views and its reasons for recommending the legalizing the office of secretary emeritus and will later, as part of the proposed changes in the constitution and by-laws, point out the steps necessary to that end.

(6) The putting into effect of recommendations as to a reduction of salaries of secretary and the retired secretary, if continued, and of editorial expense with other economies elsewhere suggested, we believe would bring down the deficit very largely, or entirely eliminate it. We believe, in brief, in cutting all expenses and all operations likely to involve such to the absolutely necessary minimum to make the budget of the Institute, all financial obligations of whatever nature included, balance.

(7) We advise that the annual meeting, which has now been adjourned until October, shall take up and carefully consider suggested alterations in constitution, that such of them as meet the approval of the membership may be put into effect at the annual meeting of 1913.

(8) We urge the board of directors likewise to inaugurate as soon as possible amendments in the by-laws so that responsibility shall be distributed and not placed upon one individual, and to put into effect still further improvements in addition to those already inaugurated by the directors.

(9) We recommend the copyrighting of all papers accepted and printed.

(10) We advise that delinquent members be dropped after 12 months' delinquency.

(11) We recommend that the election of life members be limited to 5% of the actual membership, and that the receipts from life memberships be set apart toward the accumulation of a fund for the liquidation of the mortgage and interest thereon, and not turned into the general fund of the Institute to meet ordinary expenses, and that after the indebtedness be lifted they be invested in trust funds and the interest thereon used to meet the Institute's obligations to its life memberships.

(12) We suggest for serious consideration the postponement of the publication of the "Emmons Volume" unless the directors and council are satisfied that there will be such a demand for it as immediately to meet the first expense of, say, $2100, which we understand will be payable next fall.

Finally, we wish to express our absolute confidence in the continued value of the Institute to all of its membership; our conviction of the possibility of its greater future efficiency until its publications become indispensable to the profession, and membership a coveted honor. We urge the present membership to increased interest and coöperation so that as soon as possible proposed constitutional changes may be intelligently discussed and properly authorized, and we record our fullest confidence in the board of directors and council as at present existing, which have already initiated many important changes in methods, and have continued to great advantage their efforts since the last annual meeting. Due credit should be given to those of our members who have consented and who shall consent to accept offices whose duties are and will be no sinecure, if our recommendations are adopted.

The membership should keep itself informed as to the affairs of their society, and by attendance and discussion at meetings and otherwise, inquire and criticize and be assured to their satisfaction that the business, both technical and financial, is conducted by modern methods and in a manner to insure prosperity.

Summing up, therefore, concerning the *specific* questions entrusted to us for our consideration, we recommend:

(*a*) That the vote on the constitutional amendment to change the name of the Institute be kept open for careful consideration and decision in 1913.

(*b*) We recommend a negative vote upon the amendment proposed last February, authorizing an increase in dues, believing that the economies proposed, some of which are already in effect, will not only do away with the deficit, but provide an adequate income, possibly even providing sufficient funds to liquidate the mortgage.

(*c*) We recommend a negative vote on the proposal to reclassify retroactively the present membership, leaving any reclassification of membership for a more careful consideration later on.

New Wage Scale at Butte

A committee of the Butte Miners' Union has been conferring with the managers of the Butte mining companies for several weeks with regard to introducing a new scale of wages. The old contract calling for the payment of $3.50 per day to miners, and $3 to surface men, expired May 1, but by previous agreement was to continue in force until a new contract was drawn up, or until either party to the contract gave 30 days' notice of desire to end it. On June 25, the Anaconda company made a provisional agreement guaranteeing that the present wage scale would be the minimum amount paid, irrespective of the price of copper, during the term of any contract entered into. The agreement further stipulates that the wages of all employees would be increased 25c. per day when copper is 15c. and above and under 17c. per lb. With copper at 17c. and over, all men employed underground should have an additional 25c. per day added to their wages. Also 25c. per day additional should be paid surface employees during the time that copper is 18c. per lb. or over.

In order to make this scale effective, the company attached a condition requiring that a three-year contract be entered into, and that the average price of copper during the calendar month should govern in settlement. In case any employee should for any reason terminate his employment before the end of the month, settlement should be based as follows: Settlement made during the first half of the month shall be made according to the average price of electrolytic copper for the month preceding. Settlement made during the last half of the month shall be made according to the average price of electrolytic copper during the first 15 days of the month. The company also gave notice that if the provisions of this contract were accepted before July 1, the scale would apply to the June payroll. On June 28, the men approved the new scale.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Mining on Forest Reserves

In the JOURNAL of June 22, 1912, there appears an article under this head by Merritt Booth, a mining expert in the employ of the U. S. Forest Service. The article is the usual mess of clap-trap in defense of the stupid and illegal interference of the Forest Service with legitimate prospecting on public lands. It says, that "the Service does not antagonize the locating of valid mining claims" but "such may be located only upon the discovery of valuable deposits."

I call this clap-trap and a perversion of the intent and object of Congress when the laws of 1872 were passed. The intent of Congress was to open to exploration all the lands containing deposits of valuable minerals. The Forest Service interprets this to mean that a prospector cannot locate until he makes a discovery of a valuable mineral deposit. The law requires the discovery of a vein or lode in place, but it does not require proof that the lode discovered is commercially valuable or anything like it. If the prospector thinks well enough of it to do $500 worth of work on it, Congress intended to sell the ground to him at $5 per acre.

If a prospector locate on heavily timbered ground, it will be easy to determine his good faith by the showing he has and by the diligence with which he keeps up the work. On heavily timbered land the Service should be careful to investigate fully and refuse patent, if there is a lack of good faith. On ground barren of timber or with scattering trees the prospector should have full swing as long as he has discovered a vein, no matter whether it is thin and of low assay value. That is the true interpretation of the law and there is no reason whatever why the claim should be protested, because he can show no deposit of actual value. It is enough that he is willing to spend $500 on development. On ground devoid of valuable timber the prospector acts in good faith, because his intent cannot be to profit by the timber which may grow up on it later, as he knows that it takes a century to grow a tree one foot in diameter in the Rocky Mountains.

But the Forest Service, like most other Government departments, knows no discretion and treats all alike according to its stupid interpretation of the law. It lacks common sense and the prospector, not knowing whether he can hold what he finds, does not go out at all. The Forest Service does interfere materially with the prospecting for mineral deposits and, I am afraid, it will take years to remedy the evil and inject the necessary common sense into the bureaucrats. The mining papers should hammer away, until relief is found.

MAX BOEHMER.

Denver, Colo., June 25, 1912.

Vicissitudes of Graphite Mining

I was much interested in the article on p. 1279 of the JOURNAL of June 29, 1910, on "The Vicissitudes of Graphite Mining," particularly in the statements of the U. S. Geological Survey "that there are no well established systems of treating the materials" and "certain rocks that carry graphite contain other minerals which preclude any possibility of successful concentration," these statements being directly contradicted by work being done every day on Sutton, Steele & Steele machines.

The treatment of crystalline graphite on S. S. & S. machines is an exceedingly simple one, and the separation of flake graphite from mica not at all difficult. The S. S. & S. dry-concentrating table, standard type, or the S. S. & S. jig-table. readily separates crystalline graphite from the gangue rock such as limestone, silica, etc., as well as the iron sulphides sometimes found with the flake, and produces a concentrate composed of flake and mica which concentrate is readily separated on the S. S. & S. dielectric separator.

As stated above, the treatment of crystalline graphite is a simple matter for S. S. & S. machines, the machines readily producing a flake product assaying from 93% to 95% carbon from 3% or 4% ore. E. GOODWIN STEELE,

Secretary, Sutton, Steele & Steele, Inc.

Dallas, Tex., July 2, 1912.

The Sublevel Stoping Method

In the JOURNAL of June 15, 1912, the summary of the article, "The Sublevel Stoping Method," gives among the important features "the employment of the caving principle." Please allow me to say that the caving principle is not employed in this method of mining.

Modern mining methods may be said to employ three different principles: The open-stope; the back-filling, with or without timbers; and the caving principle. The sublevel-stoping method employs the open-stope principle; and perhaps its most important feature is the large number of small sublevels, for means of attack and for the safety of the miners.

F. W. SPERR.

Houghton, Mich, July 6, 1912.

The A. I. M. E. Bulletin

Now that a well organized effort is being made to stimulate greater interest in the American Institute of Mining Engineers and make it of more benefit to the profession, it seems an opportune moment to call attention to a neglected subject, namely, discussion of the articles published in the monthly bulletins of the Institute.

The articles published in the bulletins of the English, Institution of Mining and Metallurgy, or of the Chemical, Metallurgical and Mining Society of South Africa are usually discussed at length by several members and these discussions form no small part of the bulletins. They are of great interest themselves and often enhance the value of the original article. The articles published by the American Institute are of the same general nature as those of the British and South African societies, but, so far, seem to fail to produce much contributed comment or discussion.

It is the hope of many members of the American Institute that the formation of local branches will result in a greater number of articles being contributed to the *Transactions*. The bulletins of the Institute should then be of greater interest than heretofore and that greater interest should find expression in more liberal discussion of the original articles.

Discussion or comment is complimentary to an author for it shows that his work is of interest. It brings out all sides of a question, and puts life into what is too often considered "high-brow stuff." The publication of articles that call forth no comment is too much like one person doing all the talking at a social meeting.

Perhaps American mining engineers are too reticent about expressing their views to give such discussion the value it should have. Most of the technical journals devote a page or more of every issue to discussion, but rarely are these columns used by the men whose writings would be of most benefit to their confreres. These columns seem to be regarded only as a means to repudiate some misquoted statement. Perhaps this reti-

cence arises from a feeling that the author knows more about the subject than the man who would like to comment upon the article or ask pointed questions. This is especially apt to be the case of the practical man, and he is the very one whose questions or comments would be the most interesting.

The Institute should be regarded as a technical rather than scientific society, for the former term implies a more intimate relation of its members and greater freedom in the interchange of thoughts and ideas. More discussion would promote this "get-togetherness" and there would be fewer unopened bulletins lying about office tables.

An intelligent question may arouse discussion that will teach us all a little more about a subject on which we have thought we knew all there was to be known. We have all heard that a fool can ask more questions than a wise man can answer, but even some "fool questions" may suggest something of value. Let us have more discussion so we may know more about what the other fellow thinks.

ENGINEER.

Philadelphia, Penn., June 25, 1912.

Assay

After noting the articles which have recently appeared in the JOURNAL in regard to the iodide method for the determination of copper (Feb. 12, May 25, June 15 and 22, 1912), it seems to me entirely too much stress is being given to the separation of the copper with sodium thiosulphate. The discussion is interesting but we must not lose sight of the fact that the old reliable method of separating the copper with aluminum has never been improved upon, and probably has never been equaled, for economy of time, ease of manipulation and extreme accuracy of results. Of course this method, like any other, must be correctly handled but when all the proper precautions are taken it will be found to be all that is claimed for it.

The separation with aluminum seems far quicker and more accurate than that with sodium thiosulphate as it eliminates the trouble of using a muffle, which may or may not be convenient to the laboratory, and also the dangers of a muffle ignition, including that of not being able to remove all the copper from the dish in which the ignition is performed. Furthermore the work is done entirely in the laboratory and is completely under the supervision and control of the chemist at all times. The point mentioned of the danger of oxidation of some of the metallic copper is entirely overcome by using dilute hydrogen sulphide water for washing, which is one of the essential points of the method.

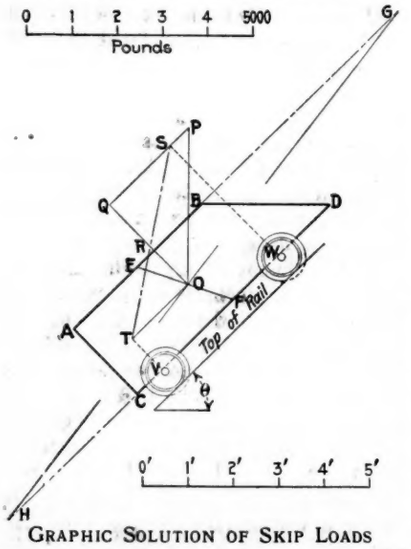
The use of sodium hypochlorite and phenol to oxidize the nitrous fumes seems entirely unnecessary, and only increases the time of operation, as bromine does it perfectly and is quickly boiled off. If care is taken to use only a slight excess of the different reagents the method will be found to be quick and accurate and with a few slight modifications is applicable to practically every copper determination the analytical chemist will ever desire to make, with perhaps the exception of copper bullion, where the much longer electrolytic method is a little more accurate, as it enables the chemist to obtain exact results in the second or third decimal place, which is a little beyond any volumetric method.

R. L. HALLETT.

Brooklyn, N. Y., July 3, 1912.

Graphic Solution of Skip Loads

I notice an article on "Graphic Solution of Skip Loads" that is very interesting. As the method I use is different from the one given by Mr. Collins, I herewith inclose the method in use by me. In the figure, the skip is supposed to be 2 ft. high, 4 ft. long on top and 6 ft. long on the bottom. The total weight of the skip and load is 3500 lb., and the angle of inclination of the shaft is 45 degrees.



GRAPHIC SOLUTION OF SKIP LOADS

The skip *ABCD* is drawn to scale as shown, and the center of gravity *O* is found as follows: From a point *E* in the middle of the line *AB*, to a point *F* in the middle of the line *CD*, draw the line *EF*. Extend *AB* to *G* and *DC* to *H*, making *BG* equal to *DC* and *HC* equal to *AB*. Join *H* and *G*, with the line *GH* and the point formed by the intersection of *GH* with *EF* will be the center of gravity *O*. Then from *O* draw *OP* vertical and to scale, making *OP* equal to the total weight of the skip and load. Draw *PQ* parallel and *OQ* perpendicular to the rail. Then *PQ* represents the pull on the bail and *QO* the total pressure on the rail.

Two alternatives now present themselves, owing to whether it is a question of design, or whether it is a question of analyzing a skip already constructed. If the former, *OR* is made equal to the load we wish on the front wheels and *QR* to that on the rear wheels. The rear wheel is then placed at *V*, making *CV* equal to the distance we wish the rear wheel from the back end of the skip. *TV* is then erected perpendicular to the rail, intersecting *TO* at *T*, *TO* being parallel to the rail.

A line is then drawn through *T* and *R*, which intersects *QP* (or *QP* extended) at *S*. *SW* is then drawn perpendicular to the rail, and *W* will be the position of the front wheel. If the skip is already made and we wish to find the load on the wheels, the above procedure would be reversed. *WS* and *TP* are erected perpendicular to the rail, intersecting *PQ* or *PQ* produced and *OT* at *S* and *T*. *T* and *S* are then joined by the line *ST*, which intersects *QO* at *R*. Then *RO* is the weight on the front and *QR* is the weight on the rear wheels.

E. R. RICE.

Miami, Ariz., June 8, 1912.

Eruption of Mt. Katmai

It may be of interest to know that the recent volcanic activity on June 6, 1912, of Mt. Katmai, which is about 400 or 500 miles to the westward, was noticeable in Prince Williams Sound. On the same day as the eruption we heard noises which we thought were ice breaking off from Columbia Glacier, 10 miles to the northwest, but which we now think were the first explosions of Mt. Katmai. For several days after the disturbance a fine, white, powder-like ashes, fell here. It was not heavy but about as thick as the dust which settles on furniture after a dirty carpet has been well swept. On June 10 the falling rain would sting hand and face and corrode everything metallic. The moisture-ladened atmosphere even rusted the tops of the polished parts of the hoist and centrifugal pumps here at the mine. Of course these machines are under roof. Brass and copper on launches and steamers turned a decided green. Vegetation was much affected the first few days, holes were eaten through leaves and their edges turned yellow.

L. L. MIDDELKAMP.

Ellamar, Alaska, June 21, 1912.

Rolling Mill No. 2 Shaft,

In the article that appeared under this caption in the issue of the JOURNAL for June 22, the JOURNAL draftsman inadvertently showed a tripod under the rock drill in the section of the shaft. This, of course, is incorrect, as one of the features of the method of shaft sinking described in the article, is the use of stoper drills with which tripod or bars are unnecessary.

P. B. MCDONALD.

Negaunee, Mich., June 29, 1912.

Electric Mine Locomotive Operation

By A. F. Elliott*

Suggestions are given concerning the operation and care of electric mine locomotives. Some of the common troubles encountered in practice with their causes and remedies are presented. The tables and formulas are useful in determining the haulage capacity and efficiency.

*Chief electrician, Mining Department, Tennessee Copper, Iron & R.R. Co., Ensley, Ala.

Before an electric locomotive is put into service, the operator should see that it is in proper condition. The journal box should be packed with wool waste and oil and compression grease cups run down and refilled. The sand box should contain plenty of dry sand and the sand levers should be tried to see that the sand runs freely on both ends before starting. The brakes should be tried to see that they are in order, and that there is plenty of travel for the brake screw and rod to allow for tightening the brakes. The controller levers should be in the "off" position before the trolley pole is put on. In starting, gradually bring the lever around, stopping on each point long enough to allow an increase in speed, but do not stop between contacts.

Slack Couplings Best in Starting

It is always best to have the first two or three couplings in the trip slack, in order to avoid having to start all the trip at once. If the trips are standing on a side track with all the couplings slack, as they usually are, it is usually better to start with the motors in series. This prevents jerking the rear cars on the trip, which may cause them to leave the track or break loose. To prevent the wheels from slipping, shut off the controller and start again, using a little sand. Too much sand may do more harm than good by preventing a good return for the current.

Always turn the controller quickly to the "off" position; that is, do not drop back point by point. Under no circumstances should the brake be used to prevent the wheels from slipping. That is the most harmful thing than can be done, causing burned-out armatures, field coils and controllers.

The locomotive should be run with the motor in series as much as possible with light loads or empty loads, and when switching empty cars. This results in saving power and prevents heating the resistance unnecessarily. No hard-and-fast rule can be made as to the proper quantity of oil or grease to be used, but one quart of lubricating oil or two pounds of compression grease is usually ample for a day's run. An excessive amount of oil or grease is detrimental, as it may get into the motors and cause the insulation to become rotten, causing grounds and burnouts. It frequently happens that if motors are lightly loaded or have considerable switching to do, the motors do not get hot enough to melt the grease in the grease box and it does not get into the bearing unless forced down. In such motors it is usually best to use oil for lubrication, having the bearings packed with wool waste. Reversing motors when running at full speed is apt to break the gears and spring the armature shaft. Insulated wire or other conductors should never be used for trolley cords. Where arc headlights are used, the light should always be cut out when the locomotive is standing idle; otherwise, the arc may increase until the globe is broken or the coils overheated.

Extra Care with New Wheels

When making the first trip after new wheels have been put on the locomotive, it should be run slowly past all switches, as a misplaced guard rail or loose switch point may cause derailment. A groove worn in the old wheel acts as a guide and tends to prevent the motor from taking frogs or splitting switches.

Contacts and contact fingers should be examined to prevent their working loose. If they are found dry and cutting, a little grease should be applied. It is not good for this purpose unless used very sparingly.

It is important to prevent the armature bearings from wearing down and allowing the armature to strike the pole pieces. It sometimes happens on a double-motor locomotive that the top of the armature bearing on the forward end becomes worn out, and the armature appears to have proper clearance when at rest, but will strike the pole when pulling a load. A good way to discover this condition is to put a piece of sandpaper on the top of the armature between it and the pole; then set up the brakes tightly and open the controller to the first or second point and off again quickly. If the armature does not mark the paper, it has at least some clearance. Another way is to chalk the armature and examine it after pulling a trip to see whether it is touching any of the poles. A good way to find the clearance between the armature and the bottom pole, which cannot be readily inspected, is to insert a piece of tin or fine sandpaper between the armature and one of the side poles. If it does not go through easily, it is time to renew the armature bearings. Brush holders should be inspected to see that the brushes work freely in them, as, if they do not, excessive sparking will occur, especially if the bearings or armature shaft are worn.

Care should be taken on all locomotives which have the motors held in place by collars on the axle to see that they are kept tight; otherwise, the side lash of the motor will be taken by the gear case, which will soon work them loose, breaking bolts, stripping threads, etc. Motors having rigid suspensions should be securely fastened to the suspension bar in such a way as to prevent hammering or chattering, as this will soon crystallize the metal, causing it to break.

Locomotives should not have new wheels in one end and worn wheels in the other, or wheels of different diameter on the same axle. Locomotives should be connected up in such a way that they will all run in the same direction with relation to the position of the reverse lever. If a locomotive persists in jumping the track, it may be due to a sprung axle, a loose wheel on axle, journal box stuck, or spring buffer or distance piece out of place.

Locomotive Troubles and Causes

Some of the more common troubles with locomotives are as follows: The locomotive will not start. This is usually due to failure of current to get through the motors, caused by an open circuit somewhere in the connection or contact. It may be due to the motors "bucking" each other, due to a wrong connection. In this event, a heavy current will flow and blow the fuse if continued. To remedy this condition, the brush leads on one motor should be reversed. A grounded resistance will prevent the locomotive from starting. It may also be caused by the brakes being set up tight, a stuck or seized bearing, or broken gears. It may also be due to a break in the track return. In this event, it is usually found that there is a sufficiently good return for a small amount of current, so that the locomotive headlights will burn and the circuit will test all right, but when the controller is opened the lights, of course, will not burn.

If the locomotive jumps or does not increase in speed uniformly, it is caused by a short-circuit in the resistance, a wrong connection of the resistance lead, contact fingers or contacts not in proper condition, or an "open" on some section of the resistance, in which case the locomotive does not start until the controller has passed that point. If it jumps on the first point, it indicates a shorted resistance or wrong connection. The wrong connection may put one or more sections of the resistance in circuit with the motor

after the controller is wide open. This will cause the locomotive to run slowly and that section of the resistance will heat when pulling a load.

Heating Due to Heavy Current

Heating is caused by anything which causes a heavy current to flow through the motor. This may be due to an overload on the motors when hauling heavy trips, rough and dirty tracks and similar causes, or it may be due to weak or shorted field coils or granulated field; charred and weak insulation on the armatures.

The heating of the resistance may be caused by running too much with the controllers on points with empty trips, switching, etc., or it may be that the resistance is connected to the controller in the wrong order; that is, the coarse resistance may be cut out first, leaving the fine sections on the last point where they have heavy current to carry. Wrong resistance panels may have been put in; or it may be due to poor ventilation.

Flashing or arcing on the controller may be caused by heavy current due to the reasons mentioned in connection with the heating of motors. It may also be caused by the fingers or contacts not being in proper condition, by the operating cylinder not moving freely and quickly. In adjusting the controller fingers care should be taken to see that the contact fingers making the final break of the arc are set to break simultaneously. This is usually the two top and two bottom fingers, and all four should make and break at the same time, the object being to split up the arc into different sections and not allow it to be broken entirely on one finger.

Well designed motors, as a rule, do not give any trouble from sparking at the commutator under normal conditions. There is, however, a certain load at which any motor will spark at the brushes. This is not particularly injurious unless it occurs a great deal of the time. It is to be expected when the locomotive is pulling a heavy load. Continued sparking at the commutator usually indicates some defect, and is frequently the first warning of some trouble that will later appear. Therefore, it should be given attention immediately.

The peculiar long blue sparks are always caused by poor connection or an open circuit in the armature winding. A shorted or burned-out armature coil causes a violent flash as the commutator bar to which it is connected passes under a brush. A common cause of sparking is high mica in the commutator. This is usually caused by the copper bars wearing down faster than the harder mica. Also, there is nearly always minute arcing between the carbon brush and the copper bars that cannot be seen and which does not affect the mica.

This can be remedied temporarily by sandpapering, but the better plan is to remove the cause entirely. This can be done by cutting down the mica below the surface of the commutator, say $\frac{1}{16}$ in. If the brushes are taken out for any cause, it is always essential to replace them exactly as they came out; carbon brushes should be set at an angle of 10° from the diameter of the commutator, and if the brushes are turned over, they do not make good contact, causing sparking.

Determination of Locomotive Haulage Capacity

In the accompanying tables are given the loads that different locomotives can haul under average mine conditions, also the size of fuse wire to use. The rule for calculating the horsepower of electric motors is as follows:

$$Horsepower = \frac{Miles\ per\ hour \times drawbar\ pull}{375}$$

To calculate the drawbar pull a certain coefficient of friction must be assumed. This is usually taken as $\frac{1}{5}$ to $\frac{1}{7}$ of the weight on the drivers but depends on whether steel-tired or chilled cast-iron wheels are used, and also on the condition of the wheels and tracks. Worn wheels will pull more than new ones and they will pull more on a large rail than on a small one.

The weight of trips a locomotive will haul depends on the grade and frictional resistance. This latter is variable and depends on the condition of tires and track. It may be as low as 20 lb. per ton on the level or it may go much higher, 60 or 75 lb. per ton. Under average conditions around well equipped mines it is usually 30 or 35 lb. per ton on level track. For each 1% grade add 20 lb. per ton.

Therefore, to calculate the weight of trip divide the rated drawbar pull of the locomotive by the frictional resistance per ton, the quotient indicating the gross weight of the trip it will haul. It should be remembered, however, that the locomotive will not have as great a drawbar pull on a grade as it has on the level, as it has its own weight to haul up the grade. The drawbar pull developed on a grade may be calculated as follows: Multiply the weight of the locomotive in pounds by the per cent. of grade used as a decimal and subtract the amount from the rated drawbar pull.

The actual horsepower developed can be calculated from the electrical input. Take frequent readings of the volts and amperes while hauling a trip and get the average of each.

$$Horsepower = \frac{Volts \times amperes \times efficiency\ (say\ 90\ per\ cent.)}{746}$$

In all the foregoing it is assumed that the locomotive has motors in it large enough to do the work without overheating. This is not always the case.

HAULAGE CAPACITY OF ELECTRIC MINE LOCOMOTIVES

Weight of Locomotive, Tons	Drawbar, Pull, Lb.	Speed, Miles per Hour	Load in Tons				
			Level	1% Grade	2% Grade	3% Grade	4% Grade
4	1600	6	50	30	20	15	11
6	2400	6	80	45	31	23	17
8	3200	6	106	61	41	30	23
10	4000	6	133	76	51	38	29
13	5200	6	173	99	67	49	38
15	6000	6	200	144	77	57	43

SIZE OF FUSE WIRE TO USE IN ELECTRIC MINE LOCOMOTIVES

Weight of Locomotive, Tons	Hp.	Amperes		B. S. Copper Wire	
		500 Volt	250 Volt	500 Volt	250 Volt
4	40	60	120	No. 17	No. 14
6	60	90	180	No. 16	No. 13
8	80	120	240	No. 14	No. 12
10	100	150	300	No. 13	No. 11
13	130	190	380	No. 12	No. 10
15	150	225	450	No. 11	No. 9

Note.—The horsepower and amperes shown above are not those calculated from the standard rating of 75 degrees temperature rise during one hour, but are based on overloads and conditions usually found in practice.

Mineral Production of Tunis

Tunis in 1911 exported minerals as follows: 34,395 metric tons of zinc ore; 36,109 tons of lead ore; 362,783 of iron ore; and 1,539,000 of phosphate rock. In addition there was an internal consumption of lead ore by the Société Metallurgique de Mégrine, in about six months of operation, says *Echo des Mines*, Apr. 29, 1912. Of the above ores, France took 10,000 tons of zinc ore; 5779 of lead, and 591,098 tons of phosphate. Belgium took 13,966 of zinc and 17,764 of lead ore. England received 237,805 tons of iron ores; Germany the remainder. The iron ore was all produced by two concessions, Slata and Djérissa.

The Dome Theory of the Coastal Plain

In a recent number of *Science*, A. F. Lucas comments on the claims of G. D. Harris for credit for the discovery and promulgation of the "dome theory" of the accumulation of oil in the gulf coastal plain and cites instances that indicate that the credit is due to him and not to Harris. Lucas says:

As early as 1894 I bored with diamond drills on Jefferson Island, Belle Isle, Weeks Island and Anse La Butte, La., discovering in each place a huge mass of rock salt of limited area but of great depth. At Jefferson Island pure rock salt was penetrated to a depth of 2100 ft. without finding bottom, and at Belle Isle rock salt, having a depth of 2740 ft. pierced in 1907, was disovered with paraffine oil and large lenses of pure sulphur.

The successful results attained by my explorations in Louisiana led me to extend the study of a nascent "dome theory" into Texas and to apply it to the various phenomena occurring on Spindle Top; a low elevation of only 10 to 12 ft. above the surrounding prairie, and to drill finally on this dome against the advice of my friends, with the well known result that the largest well ever discovered in the United States and variously estimated at from 75,000 to 100,000 bbl. per day had its birth Jan. 10, 1901.

The success of this well demonstrated the possibility of attaining economic results by drilling for oil and sulphur on the domes of the coastal plain. This theory held good throughout the hundreds of wells drilled around Spindle Top in the effort to extend the area laterally without results, however, for it was subsequently proved that if the original well had been located only 65 ft. further to the northwest there would not have been a discovery well.

It must be noted that this well was not located on the axis of "the central dome," hence the great risk incurred in its drilling, and whoever may claim that this theory does not apply, and "fools" around the rim of the dome, stands a good chance to lose himself in the quagmires of gumbos and the unconsolidated sands with which the domes are surrounded. This was proved by hundreds of wells drilled around the Spindle Top dome, not in an effort to prove a theory, but rather in the strenuous effort to extend laterally the area of the productive territory. The dome theory as advanced by me in the early days of the Spindle Top field to Dr. C. Willard Hayes and Prof. R. T. Hill, of the U. S. Geological Survey, to Lee Hager, consulting geologist, Houston, Texas, Dr. William B. Phillips, now director of the Mineral Survey, Austin, Texas, and to Eugene Coste, of the Canadian Mining Institute, has been generally accepted.

A letter to Mr. Lucas from Lee Hager and an article by Prof. R. T. Hill, published in the *Journal* of the Franklin Institute and an article by Marius R. Campbell published in *Economic Geology* are quoted to show that acknowledgment of Mr. Lucas as the originator and first exponent of the theory was made.

In conclusion, Mr. Lucas states:

"It appears that the claim made by Mr. Harris in locating wells at Pine Prairie, as noted in his article in *Science*, was quite premature, as *The Oil and Gas Journal*, of May 23, states:"

Pine Prairie, that had promise of developing another Gulf coast field, has so far failed to produce other than disappointments. Of the five tests now drilling three are at depths considerably past that at which the Myles Mineral Co. found pay in is No. 8, the discovery well, and have failed to drill into anything encouraging to test. The Producers Oil Co. set screens in No. 1 Le Danois-Hudspeth at about 2000 ft. and made a try for a well, but the effort failed to be productive, and as a result the pipe has been pulled out, broken down and the hole abandoned.

The Zimmerman Mine, Iron River District, Michigan*

An important section of the Menominee iron range, in northern Michigan, is that known as the Iron River district, just north of the Wisconsin line, and centering about Iron River and Stambaugh, along the line of the Northwestern railway. Among the companies operating in this district are the Buffalo & Susquehanna Mining Co., the Brule Mining Co., Davidson Ore Co., Florence Iron Co., Verona Mining Co., Huron Iron Mining Co., Mineral Mining Co., Jones & Laughlin Ore Co., Oliver Iron Mining Co., Wickwire Mining Co. and the Spring Valley Iron Co.

Ore is Soft Hematite

The ore found in this district is chiefly a soft red hematite, although in some places it is hydrated and classed as brown hematite. A full description of the ore beds, and of the geology of this district, is given in monographs of the geology of the Lake Superior region, U. S. Geological Survey, Vol. 52. The average analysis of the ore produced in this district in 1909, showed 54.35% of iron, and 0.404% of phosphorus, with a range of 49.87% to 56.67% of iron, and 0.709 to 0.313 of phosphorus. The ore shipped from this district is made into pig iron, as the high content of phosphorus makes it particularly adaptable for casting purposes.

Mining operations in this district began in 1882, when the Riverton mine was opened, and continued until about 1893. There was a break from 1893 until about 1898, owing to the fact that the ore was of low grade, and the financial condition of the country during these years was unfavorable. Nearly all of the orebodies being worked at present, have been discovered since 1905, largely by the extensive use of diamond drills.

Mines in the Iron River district have not yet attained any great depth. The average is about 675 ft. Such large quantities of ore have been developed on the upper levels, that the necessity for shaft sinking after two or three levels have been opened, has not yet arisen. The ore is mined for the most part on the sublevel-and-topslicing system, which has been frequently described in mining journals. As a rule, the mines are dry and require little pumping, but several situated in the valley of the Iron River, have considerable water to handle, although not enough to make pumping a serious or expensive undertaking.

*Abstract from an article, "Mining Iron on the Menominee Range," by J. F. Berteling in Mine and Quarry, June, 1912.

Two Shafts at Zimmerman Mine

A promising member of the Iron River group is the Zimmerman mine, owned by the Spring Valley Iron Co. and situated between Palatka and Stambaugh, at the southeastern extremity of the district. The No. 1 shaft, was started on this property in 1906 and is at present 275 ft. deep. In July, 1911, the second, or Clutts shaft, was begun. This shaft is much larger than the first one. There are two skip compartments 5x5½ ft., a cage compartment 6x9 ft. and a compartment for pipes and ladder 6x2 feet.

The permanent surface equipment was installed at shaft No. 1 in 1910, and includes a two-stage air compressor, having a capacity of 1380 cu.ft. of free air per min., a dynamo driven by belt, a suitable battery of boilers, and a Sullivan automatic slide-valve hoisting engine with two engines 14 in. in diameter by 18-in. stroke, and a 6x6-ft. drum, grooved for steel cable and driven by gear and pinions. The engine has a range of 150 to 180 r.p.m. and the drum of 38 to 46 r.p.m. giving a hoisting speed of from 720 to 860 ft. per minute.

In this hoist, the admission of steam to the cylinders is controlled automatically. As the throttle is opened, steam is admitted for the full length of the stroke for the first four or five revolutions to start the loaded skip from the bottom of the shaft. As the throttle is opened wide, however, the admission of steam is automatically cut off at the most economical point by means of an auxiliary cylinder. When the throttle is closed at the top of the trip, steam is again admitted for the full length of the stroke. The application of the automatic cutoff to hoisting engines of the slide-valve, geared pattern, is a patented invention of the Sullivan Machinery Company.

Modern Equipment at Clutts Shaft

Surface buildings and equipment of the most modern pattern have been installed at the Clutts shaft. The mine buildings include a dry house 100x24 ft., equipped with modern shower baths and steel lockers for 200 men. The new machine shop is 33x90 ft. and equipped to handle nearly every sort of a repair job that may be encountered. The engine house is 55x50 ft., built on a concrete foundation. There is ample space under the reinforced-concrete floor for all the pipes. This gives the engine room, a clear and

roomy appearance and at the same time the piping is easily reached.

A Sullivan automatic slide-valve hoist of the same size as that at No. 1 shaft is installed here, and will run in balance, hoisting skips of three tons capacity. The No. 1 hoist has not yet been run at anything like its capacity, either in depth or speed. At present, the production from No. 1 shaft runs from 600 to 700 tons per day of two shifts, hoisting with a single skip. No. 2 shaft is not yet operating. A smaller cage hoist is also used for hoisting men and materials, and there is a 1700-cu.ft. air compressor, a high-speed engine direct connected to a dynamo, to run the electric haulage motors underground, and the necessary high-pressure boilers.

Prior to January, 1912, the Zimmerman was distinctly a hammer-drill mine. The room- and- pillar method of mining was employed and nearly all holes drilled in the stopes, raises and drifts were upper holes. In this work, Sullivan DA-21 air-feed stoping drills were used almost exclusively, about 15 of these machines being employed. From a record, kept over a period of several months, the average footage drilled with these machines in the stope was 60 ft. per shift. Usually drilling was not started until several hours had been spent in picking down the loose material from the back of the stope. When the back was solid and drilling started early in the shift, the average footage was about 140 ft. Sullivan DB-15 hand-feed hammer drills were employed for blockholing the larger chunks or fragments of ore in the stopes.

Block-Caving System Now Used

In January, for various reasons it was decided to change the method of mining to the block-caving system. The use of hammer drills in the new system is restricted to short raises, and piston drills are used almost entirely for the main work of mining. A winze was sunk 40 ft. from the original main working level and a main haulage drift was begun along the hanging wall to connect shaft No. 1 and the Clutts shaft. Crosscuts have been run from this main drift across a block of ore, which is being caved, and raises were put up to the old main working level. These raises were widened out at the top so that when the pillars supporting the block of ground to be caved were shot, the broken ore would work into them.

The old main working level was cut by drifts and crosscuts, the pillars remaining being drilled as the work advanced, and most of the timber removed to be used over again. The new style "Lightweight" drills which are being used in this mine, have a cylinder diameter of 2⅝-in. and weigh 155 lb. These drills require about 100 cu.ft. of free air per minute at 90 lb. pressure.

This drill is of new design and contains many interesting features, one of which is the automatic oiling device. This consists of a chamber cast in the drill cylinder and holding about half a pint of lubricant. Oil from the chamber is sent into the chest by the pulsations of the air in it. The speed is controlled by two small ball check valves screwed into the top face of the cylinder and connected by ports with the oil chamber so that oil is conducted to the inlet opening in the chest. It is then carried through the machine in the form of a spray and insures positive and sufficient lubrication of every working part. These machines are doing excellent work in the Zimmerman mine.

Production

In 1909, 11,000 tons of ore were shipped from the Zimmerman mine; in the following year, 25,000 and last year 112,000 tons. Much of this ore was shipped to furnaces in Ohio and a large portion of it went to Detroit. This ore was produced entirely from development work on account of the room-and-pillar method of mining, which was then in use. I am indebted to O. P. Doty, superintendent and Thomas Clutts for the information contained in this article.

Floris Osmond

The death of Floris Osmond, the noted metallurgist, at St. Petersburg, Russia, was briefly announced last week by a cablegram, received through the courtesy of Dr. Henry M. Howe. M. Osmond was born in Paris, in 1849, and graduated from the Ecole Centrale des Arts et Manufactures, where he studied metallurgy under the late Professor Jordan. After a short time spent in the machine shops of the Fives Lille Co., he entered the employ of the Societé des Forges de Denain-Anzin, where he remained several years, leaving in 1880 to join the metallurgical staff of Schneider & Co., at their great works, at Creusot. In 1884 he gave up his position there to devote himself exclusively to the study of scientific metallurgy. It was in his private laboratory in Paris that he conducted the brilliant researches which have made his name famous on two continents. In 1888, the French Société pour l'Encouragement de l'Industrie Nationale awarded to M. Osmond a prize of 3000 fr., and in 1895 a second prize of 2000 fr. In 1887 he received the Lavoisier medal in recognition of his masterly presentation and successful defense of the allotropic theory of iron. In 1906, the Iron & Steel Institute awarded him the Bessemer medal for his work in metallurgy.

M. Osmond's written contributions to the advancement of metallurgy are numerous, many of them being exhaustive papers presented to the leading engineering societies. For the Iron & Steel Institute his more noteworthy papers were on "Critical Points of Iron and Steel," 1890; "Micro-Structure of Steel," 1891; and "Howe's Researches on the Hardening of Steel," 1896. For the joint meeting of the American Institute of Mining Engineers and the Iron & Steel Institute at London, in 1906, he and G. Cartaud prepared a joint paper on the "Crystallography of Iron." His contributions to the discussions of papers before the Iron & Steel Institute were voluminous and took a wide range. The subjects include alloys of iron and nickel, changes in iron produced by thermal treatment, cooling curves, electrical resistance of iron and steel, micro-structure of steel, current theories of hardening, aluminum steel, thermal treatment of iron and steel and influence of temperature on steel.

Some of M. Osmond's most admirable researches were those dealing with carbon conditions in steel and critical points in heating and cooling. In recognition of his important contributions to the literature of micro-structure, it has been proposed to use the name Osmondite for the structures in steel representing the intermediate stages between martensite and pearlite and for those found in hardened steels which have been tempered, and to omit the names sorbite and troostite, previously used for these transition products.

No more profound and careful student of his chosen subjects lived in our day, and his research led to many improvements. He was recognized everywhere as one of the highest authorities in the refinements of the metallurgy of iron and steel.

Cleveland-Cliffs Iron Co.

A special dispatch to *Financial America* gives the following results of operation of the Cleveland-Cliffs Iron Co. on the Lake Superior iron ranges for the fiscal year ended Dec. 31, 1911: Operations show a deficit of $233,946. During the year the company paid 17½% in dividends compared with 20% in 1910. The net profits for the year were $1,378,558, against $3,432,513 in 1910. Depreciation charges were $753,255, against $937,401, while dividends amounted to $857,250, contrasted with $982,000. The deficit of $233,946 compares with a surplus of $1,513,112 in 1910. The accumulated surplus now stands at $18,038,067 and is equal to about $370 per share on the $4,910,000 capital stock outstanding.

The restricted profits for 1911 were forecasted in the previous annual report by President Mather, although in the current report Mr. Mather states that conditions for 1912 are greatly improved.

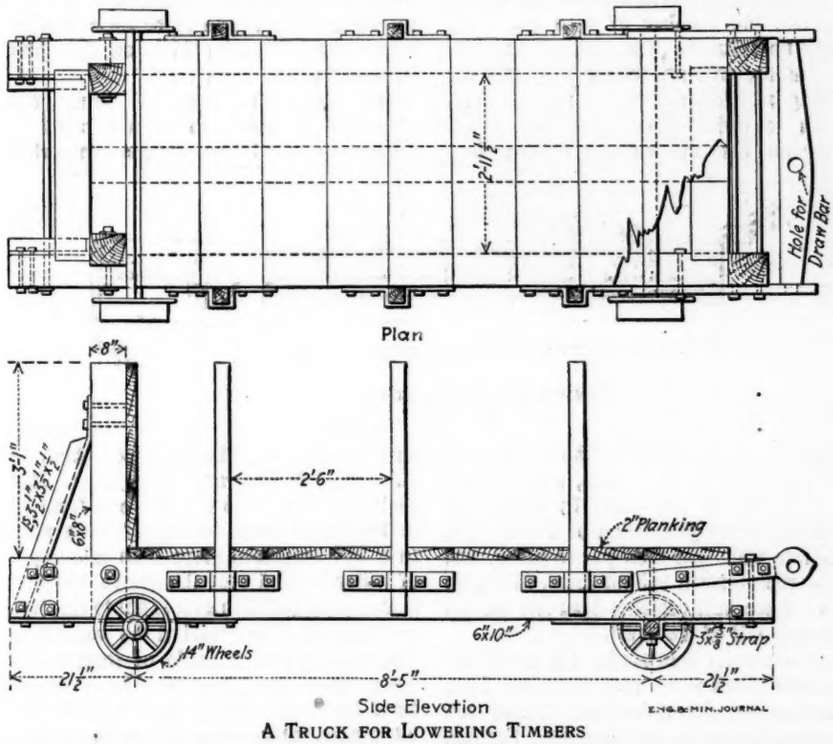
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Truck for Lowering Timber

The truck shown in the accompanying illustration is designed for lowering timber into a mine through an inclined shaft; in this particular instance the shaft for which the truck was designed had an inclination of 40° from the horizontal. The truck can be readily made by the mine carpenter and blacksmith. Bail, bridle, wheels and axles, similar to those of an ore skip, are used.

The truck consists of a platform mounted upon wheels and axles. To the back part of the truck upright timbers, against which the ends of the timbers being lowered rest, are attached as shown in the accompanying illustration. The timbers on the platform are held in place by the side uprights of which there are three at each side. In other respects the truck is operated the same as the ordinary ore skip much used in the inclined shafts of the Lake Superior copper country.



A TRUCK FOR LOWERING TIMBERS

The position of holes and order of firing, both in shaft sinking and drifting, depend to a large extent on the nature and stratification of the rock, these also affecting the quantity of explosives used per foot of advance.

Reinforced Concrete in Mine Shafts*

By E. R. JONES†

When it was first proposed to use reinforced concrete in the shafts of the Ahmeek Mining Co. and of the Mohawk Mining Co., two distinct kinds of material were tested; a good grade of gravel and natural sand from a local pit; and the trap rock, through which the shafts were being sunk, together with clean conglomerate sands from the Calumet & Hecla mills. Sets were molded from these two classes of material and installed with equal partiality and subsequent service has proved both to be equal to the demands made of them. Pieces set aside for the purpose were allowed to season sufficiently in order that a fair competitive test could be made, and it was found, that the sand and cement filling in spaces between the rounded pebbles broke away from them, while the fracture in the trap-conglomerate, with the same proportions of sand and cement, continued through the larger elements of the mixture.

The materials finally selected were No. 1 portland cement, conglomerate sand, and trap rock trommeled over ¾-in. screens. The proportions used were 1-3-5 in wall plates, end plates and dividings, and 1-2-4 in studdles. The reinforcement in wall and end plates consisted of three ¾-in. monolith steel bars with ¼-in. webs crimped on, together with two straight ¾-in. monolith bars. The dividings were reinforced by four ½-in. monolith steel bars wound spirally with ¼-in. steel wire, the whole presenting a column of square cross-section. Studdles were reinforced with two pieces of old wire rope 1¼-in. diameter. Reinforced concrete slabs were molded for the shaft lining, the materials used being fine trap rock under ¾-in., conglomerate sand and Kahn expanded metal as reinforcement. The mixture used for slabs was 1-2-4. By way of experiment, I selected a piece of No. 1 hemlock plank of the same length, width and thickness as a concrete slab, which had been seasoned for one year. I supported them at either end and placed them side by side, and then applied an equal pressure across the center of each. Three failure cracks appeared in the concrete slab just previous to the breaking of the hemlock plank, although total collapse of the slab did not occur until the pressure was considerably increased. While the method of test employed was crude, it proved to my satisfaction that the concrete was much superior to the wooden slab in strength. Considering the rapid decay of timber used as shaft lining, no further comparison of the two is necessary.

In molding the concrete sets, 2-in., No. 1 white pine was used in the construction of the forms. The forms were soaked in Delaney's wood preservative and repainted with preservative on the interior each time before setting up, thus insuring them against warping and prolonging their lives indefinitely, as well as securing a smooth and easy parting of the concrete when removed. A Smith barrel-type mixer was used in preparing the charge for the forms. The amount of water used in the mix was such that when the batch was piled, it settled rapidly without agitation. A drier mix was attempted by way of experiment, but on account of the amount of reinforcement employed, it was found impossible to ram the drier mix into place.

*Excerpt from a paper entitled "Reinforced Concrete as Applied to Mine Shafts," read before the Michigan College of Mines Club, Houghton, Mich., Feb. 25, 1912.

†Mining engineer, Ahmeek Mining Co., Kearsarge, Mich.

The labor involved in making the forms consisted of two carpenters setting up forms and keeping them in repair; one man wheeling forms on to skipways ready for filling, returning used forms to the shop and cleaning them; one man feeding mixer from stock piles of rock, sand and cement; one man delivering mix to forms and shoveling material into place; and one mason ramming charge into final positions. With this combination of men as many as four complete sets, consisting of 64 separate pieces, have been molded in one day of nine hours. In ordinary weather, the sides of the forms were allowed to remain in position over night and then removed, while the bottoms were left in place another 24 hours. The bottoms were removed by turning the pieces on their sides where they were left to harden one day longer before removal to the stock pile. All through the process of removal, the sets were handled with the greatest care in order to preserve the appearance of the set and prevent cracking, which might not develop so as to be visible to the eye until weathered. All skidways used in making and storing were brought to a level to prevent warping and bending while the sets were green, to insure a perfect set under ground, for unlike timber, concrete sets cannot be brought to place unless perfectly true. Sets should not have been used under 60 days after removing forms, although we, through the reduction of the stock piles, have been forced to install pieces of 14-day sets, but the greatest care was observed in handling and putting them in place under ground. Concrete sets one year old, which had been subjected to all kinds of weather, can be abused somewhat and handled almost as carelessly as timber.

These sets were made for the No. 3 and No. 4 shafts of the Ahmeek Mining Co. The shafts are sunk at an angle of 80°, and are 3-compartment shafts, two skipways and one manway. The outside dimensions of the compartments are; skipways, 7 ft. 6 in. high, by 6 ft. 10 in. wide; manway, 7 ft. 6 in. high, 3 ft. wide, with the end plate and dividings, making the greatest span of 7 ft. 6 in. Offsets were molded in all plates five inches from the inside face to accommodate lining slabs. Also, holes were cored for hanging and bracket bolts. The wall plates, end plates and studdles are of a cross-section of 80 sq.in., dividings 81 sq.in. The percentages of reinforcement are approximately as follows:—Wall and end plates, 5%; dividings, 5%; studdles, 3%.

It was found advisable from the beginning, because of the great weight of the wall plates, to mold them in two sections, one section spanning the ladderway and one skipway, and the other section spanning the remaining skip compartment. These two sections were connected when in place by two bolts passing through holes cored for the purpose and two straps of iron spanning the splice. Studdles were made for 4-, 5- and 6-ft. sets, to accommodate the ground passed through.

The weights of the different pieces comprising the sets are as follows: Long section of wall plate, 1035 lb.; short section of wall plate, 700 lb.; end plate, 600 lb.; divider, 645 lb.; and 3x3-in. studdles, 268 lb.; a total weight for a complete set of 16 pieces of 8104 pounds.

Taking the weight of No. 1 western fir, which has been exposed to the weather in stock piles, as 33 lb. per cu.ft., the concrete set weighs almost three times as much as a 12x12-in. timber set which the concrete set is intended to replace. Because of this additional weight of the concrete set, it was found necessary to increase the usual five or six men on the timber gang to seven. In a vertical shaft, to which the concrete sets are especially adapted, the number of men per gang might be reduced. The sets are hung or built as the ordinary timber sets, only requiring an additional rope and block with which to swing the pieces into place. After the sets are wedged to line, bottoms are put in between the plates and the surrounding shaft wall, and the set is then tied to the shaft by means of concrete in the proportion of 1-3-5. The concrete slabs are then put in place, and loose rock thrown behind them, filling up what space still remains between the set and the wall of the shaft.

After the set is in place, it is extremely important that it be well protected from the blasting, for unlike the timber set, concrete will not stand blasting. For this purpose I used flat timber and steel plates chained to the under side of the plate and dividings, and even this precaution was at times inadequate. Where the ground was breaking easily, the sets have been as near as 12 ft. to the miners, and again, where the ground was especially hard and tough, sets 40 ft. from the blast have been cut out. It is obvious that it is well to keep as far behind the mining as the ground will permit. In dangerous ground, which requires timbering close up to the sinking, timber sets were used, but had not time played an important part in the sinking, no ground was met in which concrete sets could not have been installed. With a gang of seven men, complete sets can be installed in a nine-hour shift. This permits a sinking rate of more than 100 ft. per month, which was accomplished at the No. 3 and No. 4 shafts.

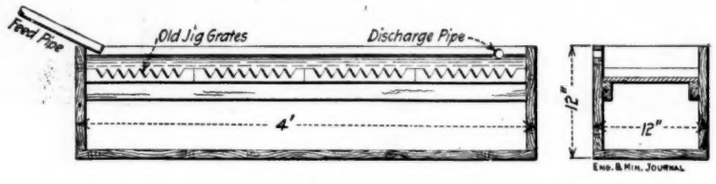
The comparative costs of the concrete and timber sets, delivered at the shaft collar is striking. The concrete set was delivered for $22.50, the timber set for $37.60. These figures are based on western fir at $28 per 1000 ft., f.o.b. car; crushed rock at 35c. per cu.yd., f.o.b. shaft; conglomerate sand at 60c. per cu. yd., f.o.b. shaft; No. 1 portland cement at $1.15 per bbl., f.o.b. works; reinforcement at $12 per set f.o.b. factory.

Joplin Method of Tempering Drill Bits

In the Joplin district a unique method of tempering the drill steel is used. It is a modification of the plunging method that retains all the advantages of plunging while there seems to be little trouble from temper checking and few drill bits break off at the shank.

The method consists of using old worn-out jig grates to form a shelf to support the drill steel in the tempering tank, which is a rectangular box about 12 in. wide, 4 ft. long and 12 in. deep. This shelf is arranged so that there is from ¾ to 1¼ in. of water on top of the grates. In a few instances more than this depth of water is used over the grates, but that is not good practice as it is apt to result in breaking off of the steel at the water line. The shelf must be made of iron, for if wood were used, the hot drills would burn into the wood enough so that the bit would not be properly cooled, and a soft drill would result. A greater depth of water is used over the grates with machine tempering than with hand work owing to the fact that it is difficult to keep the water as cool with the faster sharpening done with the machines, as when the work is done by hand.

There is a continuous feed of water going to the tank, and the amount is regulated so that by the time a drill has been put into the tank the temperature of the water is approximately at the temperature of the inflowing water. Of course the depth of the water on the grates is regulated by the overflow, which is generally a 1-in. pipe that takes the water clear out of the blacksmith shop before it discharges it.



TEMPERING TROUGH FOR DRILL BITS

By this method the tempering can be done in one heat just as in barrel plunging and there is no necessity of bathing the steel up and down in the water to prevent the sudden cooling of the steel at the water line and the breaking of the drills that would result from that. The reason for this is that the drill bit is covered with such a shallow depth of water that the steam generated by the hot steel causes the water line to play up and down on the metal and does the bathing automatically. An accompanying drawing shows the trough used in this method of tempering steel. All the tool sharpener does is to hold his steel for the right temperature, which is approximately that at which he finishes the sharpening operation, and to stand the drill on the grate in the tempering box. Once he has the water regulated properly, he has to pay no more attention to it.

Bull bits are used, with a blunt angle. In some of the mines cross bits are used, and these are also tempered by this modified plunging method. Some blacksmiths in the district say that they have been able to get as good results by this method as by draw tempering. Draw tempering is generally used on the hand steel, although some hand steel is also tempered by this plunging method. The machine steel chiefly used in the Joplin district is of the lower carbon grades not containing more than 0.60% carbon. The brands principally used are Howe-Brown, Harbord, Red Star, Black Diamond, Midvale hammered and unhammered, and Sisco Acorn.

Simple Method of Cutting Gage Glass

The following is according to the *Engineer and Fireman,* a simple yet accurate method of cutting a gage glass. Cut off and thoroughly wet the head of a match. Then, after measuring the glass, put the wet match head inside the glass at the point where it is to be cut and turn the glass several times until a distinct ring is formed on the inside. By holding a lighted match under this mark the glass may be easily separated at the desired point. By this method the glass may be cut more accurately than by the old way of marking and breaking with a file.

An Electric Pump Device

At the Franklin mine of the New Jersey Zinc Co., the electric motors driving the centrifugal pumps in the lowest station are water-cooled and hermetically sealed, compressed air from the mine system being introduced through a suitable arrangement of pipes. The purpose of this arrangement, which is the idea of R. M. Catlin, manager of the mine, and is carried out in a simple way, is to insure the operation of the pumps in the event of their being drowned.

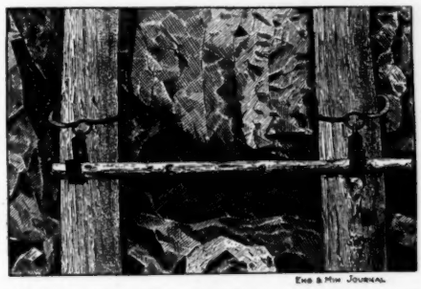
Temporary Staging Suspensions

By L. D. Davenport*

The hangers or suspensions illustrated in the accompanying sketch are used for supporting temporary staging in the Chisholm mine on the Mesabi range in Minnesota. The hangers are used in pairs to support a pole or beam, across two of which planks are laid to make the staging.

Clamps or large staples or boards spiked to the timbers in the drifts were formerly used for this purpose, but are open to the objection that they cannot be used on frozen timber.

The first hangers of the type illustrated were made with a pin or bar connecting the two hooks instead of a ring



Clamps and Pole Ready for Flooring

as shown. The hooks act in the manner of cant hooks, the greater the weight, the more firmly do they take hold of the timber. A spur on the heel of the hook prevents swinging.

These hangers are now used in the "slice" rooms at the Chisholm mine. They can be used on timbers ranging from 6 to 24 in. diameter. One of the hangers in each set is made with detachable tongs in order that they may be used with a yoke or handle as timber carriers. They may be also caught into a cap or post and used to hold a snatch block for lifting heavy timber.

Storing Dynamite Caps

Dynamite caps should not be stored with dynamite in the magazine; neither should they be stored in the open in the supply house, as is usually done, for in case of fire everybody will feel reluctant to fight fire around the supply house if he knows that there is a quantity of fulminate caps somewhere around on the shelves. At the mines of the St. Louis Smelting & Refining Co., in the Flat River district of Missouri, the dynamite caps are kept in a safe in the supply house, where there would be little danger of their exploding in case of fire.

Taking Samples from Drill Holes

It is no uncommon thing to drill holes 10 to 12 ft. deep in the walls of a vein to prospect for parallel streaks of ore in mines where the fissuring is of a sheeted type with minor breaks parallel to the main line of fissuring. This is done often where the ore makes off into small irregular pockets in shattered areas of the walls, for often along the vein walls there is little indication of this shattering.

Where the holes are flat or slightly inclined upward, it is not difficult to get the drillings for a sample, but where vertical holes are drilled in the bottom, as, for instance, to test the ore immediately underlying a blanket deposit like the sheet ground of the southwestern Missouri zinc and lead district, or for cheaply getting an idea of what is below the water level when the water in the orebody is heavy and it would be quite expensive to sink winzes, or when for some reason in making an examination of a mine some such information is desired in a hurry, the following in an ingenious way of getting the sample.

The hole is started in a depression in the floor of the working, so that the most of the sludge that comes from the hole will be caught. To prevent the scattering of the mud in drilling the hole when it is shallow, an old gunny sack or some other piece of cloth can be wrapped around the drill or a protecting collar of heavy belting be laced on the piston just above the chuck. Of course, the drillings that are thrown away by the machine with proper mudding of the hole would not greatly vitiate the results, but it is just as well to catch them, as that can easily be done. Running back of the sludge into the hole will interfere to a slight degree with the building of the hole. That can be prevented by building a clay dam around the collar of the hole.

When the hole is not deeper than 6 ft. the sample can be removed with an ordinary 1-in. pipe with the hand over the top to form a vacuum above the sludge when pulling it out of the hole. At greater depths another form of sludge bailer will have to be used. An excellent device for this purpose is a piece of 1-in. pipe with a reducer on the bottom slightly turned down to form a better seat, if a lathe be handy, although this is not absolutely necessary. The valve is a marble with a pin put across the pipe about one inch above its top so that when the sludge is poured out the marble can not fall out of the pipe. If desired a pin can be rigged in the sample can, on which the pipe is rested, so

*Night foreman, Leonard Mine, Chisholm, Minn.

as to lift the marble to discharge the sample without pouring it out through the upper end. But pouring is the more practical way of discharging the sludge from the sampler pipe. About 6 ft. is a convenient length for this pipe pump and when the hole is deeper it can be lowered into the hole by a wire, jumped up and down several times and pulled out. This is far more convenient than using a longer pipe as handling the pipe becomes awkward around the drill when it is made much longer.

This method of sampling the bottom and pumping the drillings is used in the Providence mine near Webb City, Mo., where the grade of the lower run of ore under some headings driven in mining the upper run is being tested with holes drilled from a tripod to a depth of over 20 ft. Drills with specially large bits have to be used as it is impossible when getting the drillings for a sample to resort to blasting for gage as is often done in drilling deep holes.

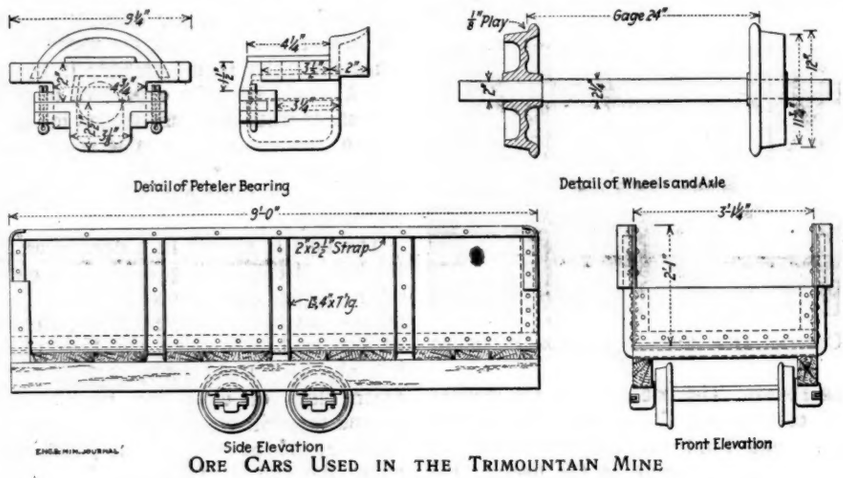
keeping the pump going at the highest pressure. Cement was tried, but in this particular case, the fine silt carried by the salt water prevented the cement from setting. In one case the only thing which worked was to ream a hole from the surface down, drive a casing through the cave, and begin boring with a smaller bit.

Especially in boring through shales is lubrication of the rods of prime importance. If the rods are first greased with melted tallow, or other suitable lubricant, and then coated with Stockholm tar, it will be found that the tar makes a smooth, useful lining in the hole, as it tends to prevent caving. In some cases the casing thus formed becomes almost as hard as cement.

Copper Range Ore Car

By Claude T. Rice

The ore car used at the Baltic, Trimountain and Champion mines, in the Lake Superior copper district, is in many respects the best mine car in the copper country. The body of the car is long and low so that shoveling into it is easy, and as the front end is open and the back end somewhat lower than the sides, it is much easier to fill it than some of the better known types of cars. The capacity of the cars is 2½ tons of the Lake Superior ore, which when broken measures 20 cu.ft. per ton. In spite of the length of the car the wheel base is short. The track gage is only 24 in. These dimensions are unique in the practice of the Lake Superior copper region. The wheels are rigidly attached to the truck and the weight is evenly distributed upon the wheels so that the car runs easily. Bearings of the Peteler type, a modification of the regulation railroad bearings in which the journal rotates in brasses, are used without waste in the oil well. The oil receptacle may be drawn out of the solid bearing casting for filling. To prevent trouble from breakage of the bearing castings, they are made of malleable iron.



Ore Cars Used in the Trimountain Mine

The bearings are carried on overhanging extensions of the axle. Because of this the axles must be made strong in order to stand the strain. Stiffening plates that also serve as wings by which the car is grasped when being turned on the turntables are used on the corners of the body. As turntables are provided at all the shaft stations the cars can always be run to the breast front end forward so that the men can shovel into them easily. Leaving the front end open requires the building of a rough wall of boulders across the front, called by the Cornish miners, a "stilling." This must be built up at the front end to hold back the fine ore, but making it does not take much time. Doors were tried on the cars, but it was found that the maintenance was heavy. Owing to the open end, it is possible to up-end the cars, put a brace under the bodies and roll any boulders into the front end of the car.

The truck was formerly made of hardwood, but as that material rots quickly underground, the truck is now made of fir, giving a much longer life. Practically the only maintenance on these cars is the replacing of the trucks. Owing to the rigid axles attached to the trucks, the gage of the track and the wheel base being only 24 in., and the even distribution of the weight of the load on the wheels, as well as the excellence of the lubrication, the tracks on the levels may be laid at a grade of three inches per 100 ft. One man can push one of these 2½-ton cars along a level track without trouble, but such a heavy car is too heavy for one man to tram, so that the tramming is generally done by men in pairs. Because of the length of the car it is not adapted to crooked drifts, although owing to the short wheel base and the rigidity of the axles, the car goes around curves without much binding.

There are many features in its construction that can well be copied elsewhere. The fact that the wheels are fastened tightly to the axle would seem at first glance to be a drawback, owing to the friction in going around curves but becauses of the short wheel base and length of the car, the men obtain such a leverage that they "slough" the car around the curve so fast that the outer wheels jump rather than slide ahead, and no appreciable increase in resistance is noted.

Some Diamond Drilling Troubles

In a recent discussion before the Institute of Mining and Metallurgy (*Bull.* 95) W. H. Trewartha James told of some troubles he had recently experienced in diamond drilling. The boring was being done in Cretaceous sand-stones, shales and conglomerates, lying at an angle of from 15° to 30° from the horizontal. In boring through the small pebbly conglomerates, a hard quartz pebble sometimes came loose from its cement setting, and from its continual movement, wedged or jammed the boring crown, and broke the stones. The shales presented even greater difficulties, although comparatively soft and uniform in structure. They contained cavities and soft parts, and when the boring tool was withdrawn the roof or side of the hole collapsed, and continued to collapse until it became difficult and dangerous to withdraw the rods. Sometimes a chopping bit could be used, and the strata chopped through,

At the Grace Zinc Mining Co. in the Joplin District during 1910, the average tons produced, per machine drill were, 22.52 tons; per shoveler, 15.5 tons; per underground man, 6.17 tons and per man employed, 3.17 tons. The tons per machine drill ranged from 18.30 to 26.38; per shoveler, 12.7 to 18.7; per underground man, 5.17 to 7.84 and per man employed, from 2.71 to 3.67 tons.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Shaking Amalgamation Tables for Tube Mill Circuit

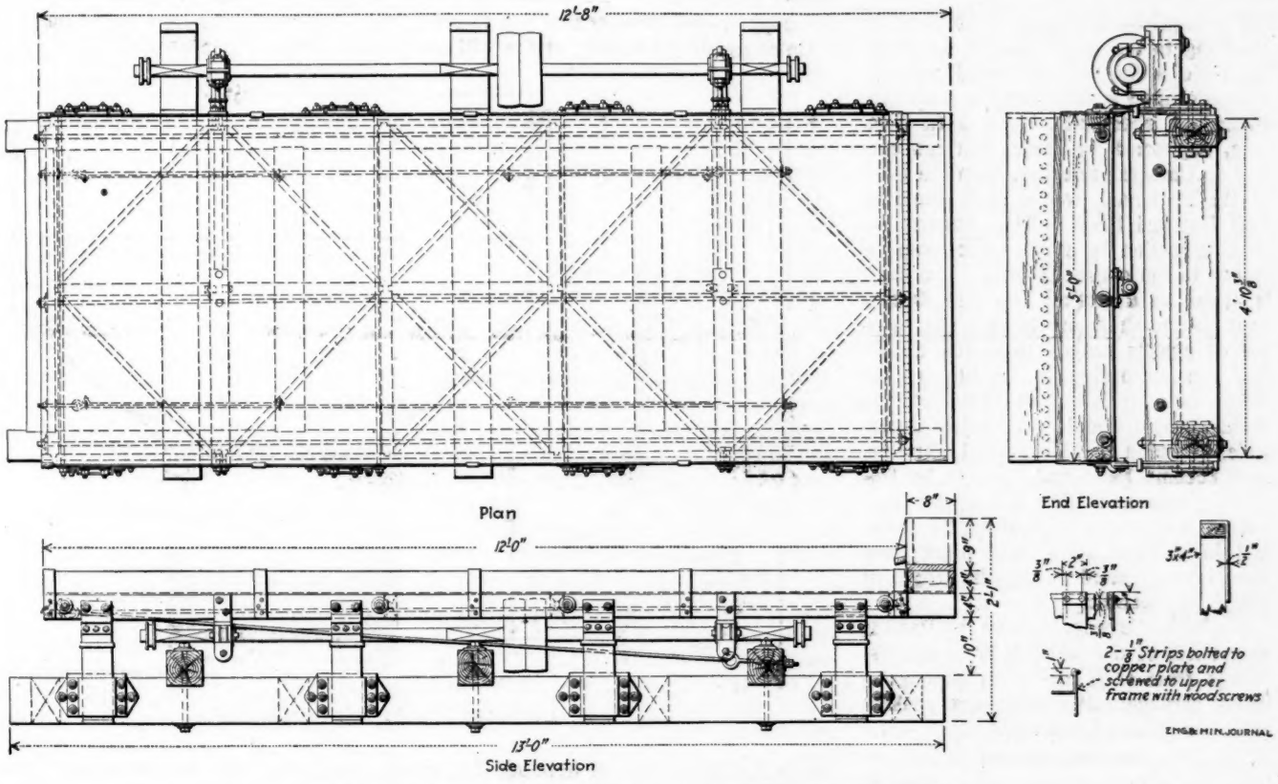
It is a common practice on the Rand to pass the product from tube mills over amalgamation tables to recover the free gold before the pulp passes to the collecting vats of the cyanide department. As the sand is introduced into the tube mill with the minimum quantity of water in order to secure efficient crushing, the issuing pulp will not flow without dilution in a launder of any practicable grade. Therefore all or a portion of the dewatering cone overflow is added to the tube mill product, making a pulp that contains 2½ parts water to one part sand. In many mills this pulp is caused to flow over shaking amalgamation tables, the table shown in the accompanying illustration being made by the Allis-Chalmers Co.; in some mills stationary plates are used.

The shaking tables are usually housed in a separate building from the tube mills. The floor is of concrete and three concrete piers are made for each table. These are built at right angles to the length of the table, and are as long as the table is wide. The piers are made high enough to permit access to the under side of the table for repairs, and are graded to the same fall as the plate, usually 10%.

The stationary frame of the table, consisting of two longitudinal beams 4½ in. wide by 7½ in. deep and cross beams bolted together, is set on the piers. Attached by bolts and large square washers to each side of the stationary frame are four wooden springs at suitable intervals to carry the shaking table. These springs are made of ash, and each consists of three leaves, the inner leaf being 17 in. long, 5 in. wide and ¼ in. thick supported on either side by a leaf 9 in. long, 5 in. wide and ½ in. thick. The upper end of each center leaf is capped with iron to support a cast-iron recess on the side of the shaking frame. In the accompanying illustration these springs are shown at right angles to the frame. In the City Deep plant the springs are fixed in a vertical position, which is a great improvement, and reduces the tendency of the table to slide down hill.

The shaking frame is made of timbers 2 in. wide by 4 in. deep bolted together. Planks, 9x¾ in., and as long as the table and about three inches apart, are secured to the frame by bolts with recessed heads, the nuts of which are accessible from below for tightening when required. The distance between the upper and lower frames is about 10 in. The springs take the weight of the shaking table, but as the whole structure has a 10% incline it is necessary to insure that slipping does not occur. This is prevented by securing each side of the shaking table to the middle of the stationary frame by two ¾-in. iron bolts about four feet long which are attached to hook bolts.

A copper plate 12 ft. long, 5 ft. 3 in. wide and $\frac{3}{16}$ in. thick is a suitable size to use on a shaking table. The size of plates selected determines the size of frame used to support it. The plate is turned up four inches on each side, thus preventing overflow and reducing the amalgamating width to 4 ft. 7 in. The turned edges of the plates are attached to the longitudinal sides of the frame



SHAKING AMALGAMATION TABLE FOR TREATING TUBE-MILL PULP

by clamps capable of being tightened when necessary. The shaking frame and copper plate should be so firmly fastened together that they move as one.

Upon the upper end of the shaking amalgamation table, is attached a distributing box which receives pulp from a branch pipe leading from the distributing launder. This box is made of 1-in. wood and is 7 in. wide and 8 in. deep, closed at each end and extending across the copper plate. The side facing down the plate is perforated near the bottom with ¾-in. holes. The shake of the table insures an even distribution of the pulp over the plate. The drop of the pulp stream from the distributing box upon the plate is liable to cause scouring of amalgam but this may be prevented by allowing it to fall upon a piece of insertion or thin board upon the plate, below the ¾-in. holes.

The required movement is obtained by attaching to the lower side of the shaking table a flat bar connected with an eccentric upon a shaft upon a stationary frame. A short 2-in. shaft 4 ft. 6 in. long, supported by three bearings carried on timbers projecting from the sides of the stationary frame, and provided with fast and loose pulleys, imparts the shaking motion by an eccentric strap attached to the connecting rod. The shaft is driven by a vertical 2-in. belt from a light countershaft overhead. The number of shakes ranges from 160 to 200 per min. according to conditions; the stroke is one inch. All parts of the shaking table should be readily accessible, as owing to the continual vibration, nuts become loose and have to be frequently tightened. The ash springs permit of the side movement of the table, and in starting up a new plant they should be adjusted to suit the length of stroke of eccentric.

A common arrangement on the Rand is to use five of the tables to treat the discharge from each tube mill, although a recent arrangement shows seven shaking tables in front of each mill.

Making up Solutions

By H. T. Durant*

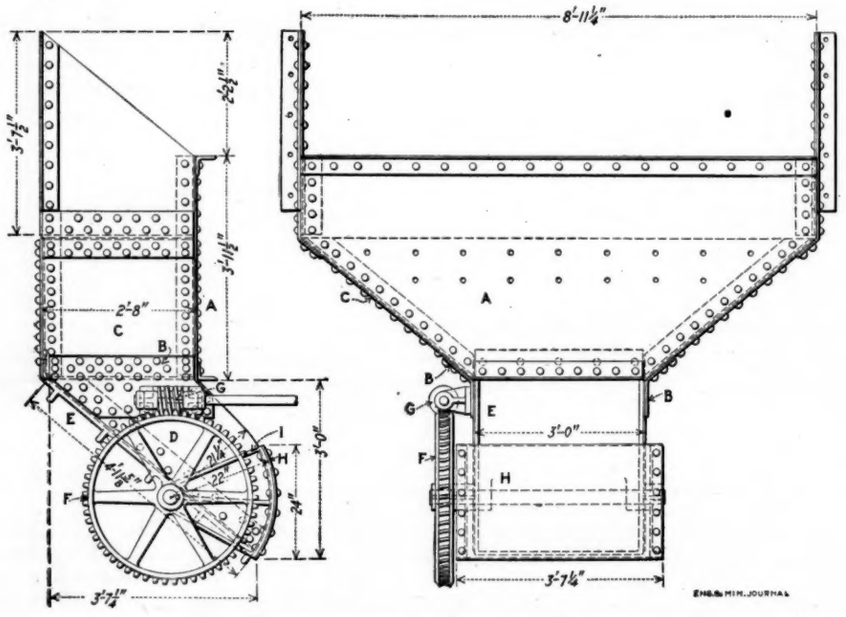
In making up cyanide and other solutions to any required strength, various tables are sometimes used. For ordinary mill and works purposes, the necessary calculations can be done mentally by the shiftmen. One ton is 2000 lb., and, therefore, one pound of anything to one ton represents 0.05% (one-twentieth of 1 per cent.). For example, a tank contains 300 lb. of solution, testing 0.04% cyanide, and it is required to raise the strength by the addition of solid cyanide to, say, 0.10%. Remembering that one pound added to one ton gives 0.05%, then it is obvious, the required increment being 0.06%, that 1⅓ lb. of solid cyanide must be added to each ton, and that, therefore, 360 lb. (300 × 1⅓ = 360) of solid cyanide will be required to raise the above mentioned 300 tons from 0.04% to 0.10%.

An alteration of the above rule would be required in the event of the ton not consisting of 2000 lb., or in event of high-grade sodium cyanide being used while still adhering to the older method of reporting it in terms of potassium cyanide, or again if the cyanide were merely reported in terms of cyanogen regardless of the base with which it is combined.

*Metallurgist, 3 London Wall Building, London, England.

Feed Gate for Coarse Ore

In the accompanying drawings are shown the details of the gates used on the hoppers that feed coarse ore to No. 6 Gates gyratory crushers at the mill of the St. Louis Smelting & Refining Co., in the southeastern Missouri lead district. The ore going to this bin is run-of-mine ore that has not passed over a grizzly. Consequently there are many boulders in the ore which no doubt would give considerable trouble from runs in case a gate closing from above was used on the hoppers.



Geared Roller Feeder for Coarse Ore

The gate is of the bottom-closing arc type. It is attached to the bottom of the feed chute coming from the hopper that is built up of front and back plates tied to side plates *C*, by angles. To this hopper the feed chute is tied by $\frac{7}{16}$-in. plates *B*. The bottom of the chute is a ribbed casting *E*, bosses on the back of which serving as bearings for the gate shaft. To this shaft are keyed two gate straps *I*, to which the gate plate *H*, is bolted. On the overhanging end of the gate shaft is keyed the toothed wheel *F*, which is operated by wormwheel *G*, carried in bearings bolted to the sides of the feed chute and through the splice plates *E*. On the end of the wormwheel shaft is a handwheel by which the attendant raises or lowers the gate. Owing to the leverage he can turn the wheel easily, but the gate moves slowly. An air piston could be arranged to operate the gate if desired.

The most interesting feature is that the gate closes from below so that the ore is stopped by damming it back at the angle of repose. Owing to the angle at which the feed chute is set, the gate does not have to be lowered all the way down and the ore feeds down to the crusher on a bed that is dammed back on the cast-iron bottom plate. In this way wear is greatly reduced. An angle iron is riveted to the front lip of the hopper in order to reinforce it. This keeps it from being bent out of shape by the boulders which often roll down with a considerable momentum. This feed gate works well. Its only drawback is that it cannot rapidly be closed in its present form, but that is easily changed if desired. Its great advantage is that it can be closed at all times without any possibility of becoming blocked by boulders.

Chemical Consumption at Montana-Tonopah Mill

At the Montana-Tonopah mill, at Tonopah, Nev., for the year ended Aug. 31, 1910, the cyanide and chemical consumption per ton of ore was as follows: Cyanide (125-130%), 2.126 lb.; lime, 7.68 lb.; zinc dust, 1.04 lb.; lead acetate, 0.345 lb.; and acid, 0.38 pounds.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Cathode and Wire Bar Conductivity

Some dirty cathodes were deposited from impure leady anodes in an electrolyte analyzing as follows, in grams per liter: Acid, 113; $CuSO_4.5H_2O$, 131; As, 16.6; Sb, 0.50; Cl, 0.022; Ni, 17.9; Fe, 2.2 (*Bull.* A. I. M. E., June, 1912). Analyses of the anodes and the refined products were:

Calculating that all the silver in the cathode comes from floating slime, and that this slime is of the same composition as the regular slimes, the contamination of the cathodes due to slime would have been: Ag, 0.9; As, 0.00113; Sb, 0.00195; Ni, 0.00096, and the difference between

	Au, Oz. P.T.	Ag, Oz. P.T.	Cu, %	Pb, %	As, %	Sb, %	Ni, %
Anodes	0.83	213.9	96.59	0.65	1.00	0.32	0.2044
Cathodes	.....	0.9	.....	.....	0.0016	0.0019	0.0028
Ingots	.....	3.8	99.933	.....	0.0040	0.0048	0.0046
Slimes	25.8	5434.2	8.6	22.5	6.8	11.8	5.8

these figures and those in the table (practically negligible), would be due to electrolytically deposited impurities. Wires were drawn direct from the cathode, which tested 99.3 hard-drawn, while wires from the ingots gave 94.6 hard-drawn.

Boiler Corrosion

An interesting case of boiler corrosion stopped by a knowledge of physical chemistry, is instanced in *Engineering*, June 14, 1912. The corrosion was due to chemical action by sulphur, and not by electrolysis, as that term is ordinarily used. Serious pitting had started in a stand-by boiler at the generating station of the London Electricity Supply Corporation, which caustic soda was found powerless to stop. On examining the boilers numerous blisters were seen, varying in size up to 30 mm. in diameter, the bulk of them being just below the water-level. On pricking the blisters each was found to contain a liquid with a fine black powder in suspension, and a pit was seen to be forming in the center of each blister. Analysis showed that the liquid was a solution of ferrous sulphate, containing free sulphuric acid, although the water in the boiler was alkaline and contained much less sulphur than the liquid in the blisters. The pitting was traced to the sulphide of manganese in the steel, which by oxidation gave rise to free sulphuric acid, which attacked the iron, forming ferrous sulphate. This being oxidized to ferric sulphate by the oxygen in the water would attack more iron, and in the quiescent water of the stand-by boiler the oxides precipitated by the alkali in the water would not be washed away, but would seal in the corrosive liquid with a semi-permeable membrane, through which the oxygen of the water could pass, but not the caustic soda. The use of sodium arsenite instead of caustic soda completely stopped the trouble, the arsenite presumably using up the oxygen in the water.

Ferroxyl

A reagent to which the name ferroxyl has been given by its inventors, Drs. Cushman and Walker, is being used to show the electrolytic corrosion of iron and steel (*Engineering*, June 14, 1912). Ferroxyl is a jelly containing in solution phenolphthalein and potassium ferricyanide. The phenolphthalein gives a pink color in the presence of hydroxyl ions, and the ferricyanide gives a deep blue precipitate in the presence of soluble ferrous iron. The jelly merely serves to localize these effects and prevent them from running into one another. If a piece of iron or steel is placed in the melted jelly and the jelly allowed to set, there are developed on the surface of the metal pink areas and blue areas indicating the positions of nodes of opposite polarity. The blue color shows the anodic areas where iron is going into solution, the pink color shows the cathodic areas where no iron is being dissolved.

Lackawanna Cement Tests

The new tests prescribed by the Delaware, Lackawanna & Hudson R.R. for cement, of which it is a large user, are given in *Engineering News*, June 13, 1912. Neat briquettes are made up as usual, and after being kept in a moist closet for 24 hr., are placed in an autoclave, and well covered with water. Steam pressure is then raised to 285 lb. per sq.in., the time required for this being about 45 min. The pressure is then maintained about 1½ hr., making a total of 2 hr., and the autoclave blown off. Those briquettes remaining intact are then broken in a standard cement-testing machine. If the briquettes stand this test they are ordinarily of first-class quality.

It has been found that properly seasoned cement usually passes a better test than fresh, and that quality is improved by fine grinding, consequently the Lackawanna is requiring that 78% of the material furnished it shall pass a 200-mesh screen.

The engineers of this road believe the failures noted by them come under the following heads, which can be used as a guide board by other users: (1) Use of inferior grades of sand and stone, and badly mixed concrete, or insufficient water to permit the concrete to attain its full strength. (2) Failure due to freezing of concrete placed in winter before the final set was attained, due to calcium chloride, or due to placing concrete in very hot weather when the temperature of the water is around 90 or 100°, the cement also being improperly seasoned. It takes an initial set in the mixer, and is broken when placed in the work. (3) Failures due to green cement, or improperly manufactured material.

Reduction of Carbon Dioxide by Carbon

The velocity of the reaction $CO_2 + C \longrightarrow 2CO$ has been determined by Rhead and Wheeler for various temperatures (Chem. Soc. *Proc.*, p. 104, 1912; abstr. in *Journ.* Soc. Chem. Ind., May 31, 1912). The velocity of reaction increases with increase of temperature, the mean velocity ratios for a temperature interval of 10° diminishing fairly regularly as the temperature scale is ascended.

Thus, in a series of experiments in which a mixture containing 20 per cent. of carbon dioxide and 80 per cent. of nitrogen was employed, the following mean values of k at different temperatures were obtained

$$\left(k = \frac{1}{t} \cdot log. \frac{C}{C_t}\right)$$

Temperature	k (t = 1 minute)
900°	0.00060
950	0.00374
1000	0.01764
1050	0.05760
1100	0.10570

The mean velocity ratios for an interval of 10°, obtained from the expression

$$\frac{k_t + 10}{k_t} = 10^{10b}$$

are given in the following table, together with the values of b obtained from the experimental numbers:

Temperature Range	b	$\frac{k_t + 10}{k_t}$
900— 950°	0.01589	1.44
950—1000	0.01346	1.36
1000—1050	0.01028	1.27
1050—1100	0.00527	1.13

Proposed French Nickel Coinage

M. Klotz, Minister of Finance, submitted at the last meeting of the Cabinet a proposal to substitute smaller perforated nickel coins for the present copper pieces of 5 and 10 centimes (100 centimes, 19.3 cents) which resemble the British halfpenny and penny pieces, says the London *Times* of June 10, 1912. The proposal contemplates the issue of 80,000,000 francs of the new perforated coinage in pieces of 5, 10 and 25 centimes. Nickel pieces of 25 centimes are already in circulation, but they are not perforated. The object of perforation is to make the new nickel coins distinguishable by the feel from coins of similar size in silver. If Parliament adopts the Government proposals the value of the copper coin which will be withdrawn from circulation is estimated at 59,000,000 francs. The copper would be used for the future coinage of centimes, for colonial coinage, and for the execution of various orders for coins received from abroad.

Thermal Balance of the Electric Furnace

The thermal input of the electric furnace for pig-iron making was worked out by the Trollhättan engineers for the period Sept. 3 to Oct. 1, 1911, as follows (*Met. and Chem. Eng.*, July, 1912): Combustion of CO_2, 567 Cal.; combustion of C to CO, 381 Cal.; electric energy, 1504 Cal. The output was as follows:

Use	Cal.
Consumed in reduction	1620
Decomposing limestone	35
Evaporating water	24
Carried off by gases	26
Carried off by slag	75
Carried off in iron	300
Cooling water	195
Transformer losses	43
Conductor losses	44
Radiation and conduction	90
Total	2452

Bauxite in Cement

The addition of bauxite to cements is stated to allow regulation of the time of setting and of the resistance (Fr. pat. 437,860). The bauxite is also stated to stabilize the lime in them, and to produce a quick setting, highly resistant product. The bauxite cements, as well as addition products with lime and plaster, are covered by the patent, as well as the processes of manufacture.

Alumina for Drying Gases

The use of alumina as a dehydrating agent for gases which act upon phosphorus pentoxide is suggested by F. M. G. Johnson (*Journ.* Am. Chem. Soc., July, 1912). The alumina is prepared by the gentle ignition of aluminum hydroxide, and is effective until it gains about 18 % of its weight (a hydration corresponding to $Al_2O_3.1H_2O$). The alumina is regenerated by heating the tube in a smoky flame, while passing air previously led through sulphuric acid, through it.

Melting Points of the Elements

The accompanying table has been taken from an article by G. K. Burgess in the *Journal* of the Washington Academy of Sciences, July, 1911, except for a recent value for the melting point of tantalum, which is lower than that given by him.

MELTING POINTS (C°) OF THE ELEMENTS

Element	Melting Pt.	Authority
Helium	<−269?	B.P.He = −268.5
Hydrogen	−259	Kamerlingh-Onnes
Neon	−253?	Travers-Jaquerod
Oxygen	−230?	Range −227 to −235
Fluorine	−223	Moissan-Dewar
Nitrogen	−210.5	Fischer-Alt
Argon	−188	Ramsay-Travers
Krypton	−169	Ramsay-Travers
Xenon	−140	Ramsay-Travers
Chlorine	−101.5	Johnson-McIntosh
Mercury	−38.7 ± 0.5	
Bromine	−7.3	Range −7.5 to −7.0
Caesium	26	Range 25.3 to 26.5
Gallium	30.1	Lecoq-Boisbaudran
Rubidium	38	Range 37.8 to 38.5
Phosphorus	44.1	Hulett
Potassium	62.3 ±0.2	
Sodium	97.5 ±1.0	
Iodine	114 ±1	
Sulphur	113.5 to 119.5	Various forms
Indium	154.5 ±0.5	
Lithium	186	Kahlbaum
Selenium	217 to 220	Various forms.Saunders
Tin	231.9 ±0.2	
Bismuth	270	Range 267.5 to 271.5
Thallium	302 ±1	
Cadmium	321.0 ±0.2	Range 320.0 to 321.7
Lead	327.4 ±0.4	
Zinc	419.3 ±0.3	Range 418.2 to 419.4
Tellurium	451 ±1	
Arsenic	500	Guntz-Broniewski
Antimony	630 ±1	"Kahlbaum" purity
Cerium	645?	
Magnesium	650 ±2	
Aluminum	658 ±1	
Calcium	805 ±5	
Lanthanum	810?	Muthmann-Weiss
Strontium	>Ca, <Ba?	
Neodymium	840?	Muthmann-Weiss
Barium	850	Guntz
Germanium	<Ag	Winkler
Praesodym	940?	Muthmann-Weiss
Silver	961 ±2	
Radium	600 to 1200?	Unknown
Gold	1063 ±3	
Copper	1083 ±3	
Manganese	1225 ±15	
Yttrium	1000 to 1400?	Unknown
Samarium	1300 to 1400	Muthmann-Weiss
Scandium	1000 to 1400?	Unknown
Silicon	1420 ±15	
Nickel	1450 ± 10	Day-Sosman = 1452
Cobalt	1490	Day-Sosman
Chromium	1505 ±15	
Iron	1520 ±15	
Palladium	1550 ±15	Day-Sosman = 1549
Zirconium	>Silicon	Troost
Thorium	>1700, <Pt	Wartenberg
Vanadium	1730 ±30	
Platinum	1755 ±20	Waidner-Burgess = 1753
Beryllium	>1800	Parsons
Ytterbium	1600 to 2000?	Unknown
Titanium	2200 to 2400?	Weiss-Kaiser
	1800 to 1850	Hunter
Rhodium	1920?	Range 1907 to 1970
Ruthenium	>1950	Joly
Niobium	2200?	v. Bolton = 1950
Boron	2200 to 2500	Weintraub
Iridium	2300?	Range 2100 to 2350
Uranium	near Mo	Moissan
Molybdenum	2500?	Range 2110 to >2500
Osmium	2700?	Waidner-Burgess
Tantalum	2850	Deutsche Phys. Gesell.
Tungsten	3000 ±100	Range 2575 to 3250
Carbon	?	Waidner-Burgess =3080
		Unknown

Power Used in Cement Industry

The distribution of power in a cement plant using soft limestone and shale is given by R. K. Meade in the *Journal* of the Engineer's Club of Baltimore, July, 1912. The clinker is burned hard and is difficult to pulverize.

POWER DISTRIBUTION

	Per Cent.
Air drills in quarry	2.0
Stone to crushers	0.4
Limestone crusher	1.8
Shale crushers	0.1
Dryers	1.8
Raw ball mills	5.2
Raw fuller mill	21.8
Kilns	5.9
Coal mill	4.2
Clinker ball mills	2.0
Clinker fuller mills	43.2
Shipping and packing	1.4
Loss and lights	10.2
	100.0

In the accompanying table the power required in each step to deliver the material to the next, is included.

Roughly speaking, material should be prepared for the kilns at an expenditure of between 15 and 20 kilowatt-hours per ton, or 5 to 7 kilowatt-hours per bbl. of cement produced. For the operation of the kilns and driers, including pulverizing the coal for the former, about 2 kilowatt-hours should be sufficient, while for the reduction of the clinker to cement, a final 7 to 10 kilowatt-hours will be required, or in all, from 14 to 19 kilowatt-hours, or 0.7 to 1.06 horsepower-days, per bbl. If a kilowatt-hour is rated at about three pounds of ordinary coal, a barrel of cement represents from 42 to 57 lb. of coal for power and 80 to 100 lb. for burning, or 122 to 157 lb. in all.

Oldest American Iron Furnace Razed

Rapid work has attended the razing of the Port Henry, N. Y., stack of the Northern Iron Co., said to be the oldest furnace in the United States, which is being removed to clear the site for the erection of a new stack, says *Iron Trade Review*, June 27, 1912. The shell, which is double, and its appurtenances, were torn down in about two weeks and workmen began the building of the foundation for the new furnace. The use of an oxy-acetylene torch greatly facilitated the removal of the double shell and structural iron and steel work. The Northern stack was erected in 1872 and 1873 and the first iron was made in August, 1875. Its blowing engines are also said to have been the oldest in use in this country.

Reduction of ZnO by H

Zinc oxide is completely reduced to zinc by heating in a slow current of dry hydrogen (*Bull.* Soc. Chim. Belg., p. 106, 1912). This reaction is reversible in the case of nascent or any other hydrogen that is not absolutely dry.

Recovering Burned Dredge Machinery

By Lewis H. Eddy

The work of recovering the machinery from a 15-cu. ft. Natomas dredge, burned in October, 1911, occupied 104 days. After pumping out the pond and removing burnt timber, much the same methods were used in recovering the machinery as are employed in dismantling a dredge at the end of its commercial usefulness. The digging ladder was removed in two sections and required especially strong tackle.

The machinery of Natoma No. 8 dredge of the Natomas Consolidated, destroyed by fire on Oct. 20, 1911, in the American River district, Calif., has been recovered from the flotation pond and the work of overhauling the wrecked material completed. The pond is entirely clear with the exception of the two steel spuds standing upright as they were when the boat went to pieces. The spuds will remain in their present position until the new dredge is launched when they can be handled with advantage and economy. Besides the spuds the only parts of the burned dredge not brought ashore are four buckets that are sunk 20 ft. in the mud in the bottom of the pond, and some smaller pieces of material, all of which can be raised with the digging ladder of the new dredge.

Of the 72 buckets recovered 69 are intact, two have broken eyes and one has a battered lip. Some of the parts of the machinery withstood the fire and the shock of the breaking up of the boat without apparent costly damage; other parts are unfit for further use in dredge construction. The hull was only partly destroyed by the fire, but it was necessary to wreck the entire structure in order to take out the machinery.

Fired by the Transformers

The fire, which was caused by a disturbance of the electric transformers, started about 9 p.m., Oct. 29, 1911, and by 11 p.m. the boat sunk stern down. The housing burned during the following day and was extinguished by pumps operated from the shore. The wooden parts of the stern gantry were burned and the steel parts fell into the water. The bow gantry remained intact, though listed to port. No injury was done to any of the workmen. The work of recovering the machinery was started on Nov. 2, 1911, and completed on Feb. 14, 1912, a total of 104 days. The water was turned into the pond on Feb. 28. The work of recovery and overhauling was done by the Yuba Construction Company.

The initial work of recovery of the wrecked machinery was to pump the water from the flotation pond, begun immediately after the fire had been extinguished. This was done with two 30-hp. pumps. The removal of all the burned timbers and other remaining wooden parts followed. The position of the boat, the stern burned away and sunk and the bow standing firm though listed to port, saved the bow gantry from damage, while the stern gantry went down of its own weight when the wooden parts had burned away. The revolving screen and some other parts of the machinery remained practically in place. The first direct work of recovery consisted of taking down the main drive and the screen and disconnecting the bucket line. The buckets in the upper part of the line were first taken off to facilitate the removal of the upper tumbler and the hopper. The destruction of the superstructure and the breaking out of the burned portions exposed the machinery to advantage, so that a considerable proportion of the machinery was removed with the same precision as would be employed in the dismantling of a dredge that had gone out of commission at the expiration of its term of commercial usefulness.

There were conditions to be met that are not common to the ordinary dismantling of a dredge, the most serious of which was the removal of the bucket ladder which had fallen across the port pontoon and rested at an angle of 30°. But before attempting the removal of the ladder the two winches and the smaller machine pumps and other material were taken out, followed by lifting the tailing stacker which had broken into two parts. All of the lifting and hoisting had so far been done with a shore derrick with a 25-hp. electric motor.

Digging Ladder Removed in Sections

The bucket-ladder frame or digging ladder, as it is commonly termed, was constructed in four sections. The upper section weighed 27 tons, the second section 23 tons, third section 22 tons and the lower section 30 tons, a total of 102 tons. Added to this weight, in the position the ladder occupied on the dredge were: The lower tumbler, 11 tons; the suspension hanger, 12 tons; and blocks, 6 tons; total weight to be lifted, 131 tons. Tackles were rigged on the bank of the pond and the ladder first straightened. Then the upper and the adjoining section were hoisted separately. The two lower sections were then righted. These two sections of the ladder and the attachments were hoisted with an "A" frame constructed on the bank of the pond.

Hoisting the upper of the two sections was not so difficult as it was to hoist the lower section to which was attached the suspension parts, the lower blocks and the lower tumbler. The tumbler rested on bedrock and was imbedded in 23 ft. of precipitated mud that had hardened and cemented. The ground in which the dredge had been digging is locally known as Rebel Hill; the cemented character of the gravel has required the employment of monitors for initial breaking of about 25 ft. depth and the operation of specially constructed dredges for the digging. It was found to be impossible to move the lower section of the ladder and the attached tumbler without first loosening the cemented mud by the use of powder. Even when this was done the lifting of the 59 tons of machinery and several tons of mud required an especially strong rigging.

Strong Tackle Required

The "A" frame by which the hoisting was done was built on a piece of timber as a base 22x24 in. by 24 ft. long. The legs of the frame were 18x18 in. by 34 ft. high; the cap was 18x24 in. laid on edge; the legs stood on a batter 3 to 1; the two upper ends were 2 ft. 6 in. apart inside. Steel gusset plates fastened the cap to the legs. The top corners were protected from crushing by two angle plates 8 in. wide, 1 in. thick and 4 ft. long. The tackle was carried by clamps on the stern gantry of the dredge. The upper block of the tackle was composed of five sheaves with 1-in. rope; the lower block of four sheaves. Another tackle was suspended from the top of the "A" frame carrying the same size rope. Besides these there were two tackles of three blocks each placed on the ground and over the base of the "A" frame leading down to the lower section of the ladder. The two tackles on the ground were fastened from the inner end to a deadman. One-inch cable was used for this rigging, and all the gear used was made up from material taken from the wrecked dredge. The rigging was operated with a 30-hp. electric motor.

Bow Gantry Not Damaged

The bow gantry, which was not damaged by the fire, stood in place until removed in pieces, showing the result of the excellent workmanship employed in its construction. All the blocks were still hanging, and the gantry rested on its footing in the hull of the boat as it had been placed in construction. The hull of

the boat though not wholly destroyed, was badly racked. The stern gantry was wholly destroyed; it was apparent that the posts had burned, and let the structure fall; the steel material of it was all taken out of the wreck.

The derrick employed in handling the wreckage was of 20-ton capacity, but in this work was required to lift loads greatly in excess of the rating. It is one of the six derricks employed by the Natomas Consolidated in the construction of dredges in the Natoma field. The mast is 105 ft. high, the boom 95 ft. long, each made in four sections.

The entire work of wrecking, recovery and overhauling the machinery was done as systematically and with almost the same precision and expedition as the dismantling of a dredge in ordinary condition or the construction of a new dredge. The machinery and material are laid out on shore in such order as to make their further use or removal convenient and economical. Whether or not any of these parts will be used in other dredge construction by the Natomas Consolidated has not been decided; but a new dredge with steel hull is to be built to take the place of No. 8 and the design and making of the machinery is in progress. This will be the second California gold dredge to be provided with a steel hull.

The First 15-cu.ft. Dredge in America

Natoma No. 8 dredge was the first 15-cu.ft. gold dredge built in North America. It was designed and constructed in 1910, the machinery tried out in December of that year, and the boat put into commission on Jan. 8, 1911. At the time of the fire it was digging 55 ft. below the water line and averaging 275,000 cu.yd. of gravel per month. The constructional details of this dredge were given in the Journal of July 8, 1911. The dredge was built for the Natomas Consolidated of California by the Yuba Construction Co. of Marysville, California.

Yellow Pine Mill, Goodsprings, Nev.

By Fred A. Hale, Jr.*

The treatment of the ores of the Yellow Pine mining district, Clark County, Nevada, has presented numerous difficulties, owing to the complex nature of the ore, and to the closeness of the specific gravities of the valuable minerals contained, rendering the ore hardly amenable to ordinary methods of concentration. Numerous methods have been attempted, the most notable being the leaching plant erected in 1900 by the Mineral Union Co., Ltd., but all proved unsuccessful, until the present plant, operated by the Yellow Pine Mining Co., was completed last fall.

Metasomatic Replacement in Limestone

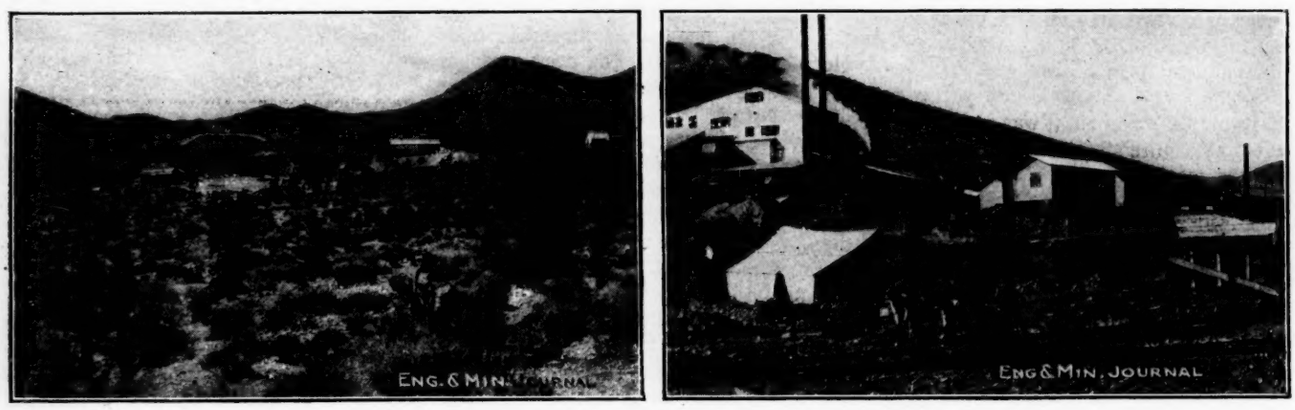
The orebody of the Yellow Pine Mining Co. consists of a metasomatic replacement in the carboniferous siliceous limestone. The limestone in the ore zone has been completely replaced by lead and zinc carbonates, although there are occasional ribs of coarse limestone within the orebody. The ore, when free from lime, assays about 30% zinc, 16% lead and 12 oz. silver, the zinc being in the form of mixed smithsonite, calamine and hydrozincite. About 75% of the lead content is cerussite, the remainder being anglesite and secondary galena, and the silver is apparently contained within the lead in an oxidized form.

This ore is readily marketable in the crude state on a so called "mixed ore" schedule, but the nearest market being the zinc smelters in the Mississippi Valley, excessive freight rates and high treatment charges absorb most of the profit, so that the producer obtains only about one-fifth of the actual value of the ore. For several years, the Yellow Pine Mining Co. has been working on a method to separate the valuable constituents in the ore, and, while the results from tests by ordinary concentration methods were far from satisfactory, the company was sufficiently encouraged to decide that a specialized method could be worked out which would give good results on the ore. Consequently, the old leaching plant of the Mineral Union Co. was purchased and remodeled to its present condition.

In order to facilitate sorting, the ore is screened at the mine, the skip dumping directly on to a shaking grizzly, having ¾-in. openings. The screenings, amounting to about 50% of the ore, are kept separate from the coarse and the two are transferred to the mill at Goodsprings, four miles distant, by a narrow-gage railroad, owned and operated by the company. Here the two are dumped into separate bins at the head of the mill, having a total capacity of 300 tons.

From the bin, the fine ore is elevated directly to the fine-ore bin, and the coarse is fed on to an 18-in. conveyor belt, which, at an inclination of 30° , elevates the material to the rock breaker. Four ore sorters are employed, and only clean limestone is picked from the belt. The conveyor belt discharges into an 8x12 Blake crusher, where the ore is crushed to 1-in. size, and dropped into the fine-ore bin. The ore from the fine-ore bin is fed automatically into a set of 16x30-in. Gates rolls, which reduces it to 7 millimeters.

From the rolls, the ore is elevated in a 10-in. vertical elevator to a set of two 3x3-ft. Colorado impact screens, the coarsest having 4-mm. openings, and the fine screen being about 20 mesh. The oversize from the coarse screen passes to a two-compartment Harz jig, which removes practically all the galena in the ore and some lead carbonate, the jig tailing going to another set of 16x30-in. rolls for regrinding, the product from which is again elevated and passed through the screen system. The oversize from the fine screen passes to a second 2-compartment jig, the middling from this jig being sent to the regrinding rolls. A lead



Yellow Pine Mine and Mill at Goldsprings, Nev.

*Mining engineer, Goodsprings, Nev.

concentrate is drawn from the hutch of the second jig and also from the first compartment, while the tail is sufficiently low in lead to go directly to the tailing bins.

Special Overstrom Classifier

The undersize from the fine screen, a 20-mesh product, flows to a classifier, designed especially for this ore by G. A. Overstrom, consulting engineer for the company. This classifier is worthy of special mention, as the successful treatment of this ore is largely due to the close classification and table work. The classifier is of the inverted type, i.e., the slime is removed in the first compartment instead of in the last, as is usual with most hydraulic classifiers. The hydraulic water is introduced in the bottom of the classifier through a 6-in. main, drawing from a special tank kept at a constant head by means of a float valve. The classifier has six compartments, formed by vertical partitions, and the velocities in the different compartments are varied by their different area of cross-section.

The classified products flow from the top of these compartments and a plug is inserted in the bottom of the final compartment to enable the withdrawal of any oversize too large to be elevated by the upward current. This classifier makes a cleanly divided product, 90% of the slime being removed in the first compartment, and requires little or no attention, there being but the one valve to adjust. The discharge from each compartment of the classifier goes to a special table of the Overstrom straight-line type, but especially designed for this ore. Grooved linoleum is used instead of wooden riffles, and a feature of the table work is the varying size of the tables.

The table taking the coarsest feed is 16 ft. by 4 ft. 6 in., and the slime table is 10x7 ft., the tables taking the intermediate sizes being of a proportionate length and breadth between these two limits. This has been found to effect a closer concentration, with an increase in the capacity of the table, owing to the minimum of waste space on the table.

A middling product is drawn from the first two tables, and returned for regrinding, but the remaining tables make but two products, concentrate and tailing. The concentrate is wheeled to the storage bin and loaded into cars for shipment. The tailing passes to dewatering bins, and is drawn from them into cars and thence to a platform, where it is dried for shipment. Water is not plentiful and all that is possible is returned for re-use. About 10% of the tailing is a slime product, which, after being thickened in cone-settling tanks, is run into slime ponds to dry for shipment.

All Separated Products Shipped

It can be seen that the mill is essentially a separating plant, rather than a concentrator, and all products are shipped, except the waste limestone picked from the belt. From a mill head, averaging 28% zinc, 17% lead and 10 oz. silver, a lead concentrate is produced averaging 62% lead and 45 oz. silver, while the tailing contains 33 to 35% zinc, making both profitable shipping products. The capacity of the mill is 75 tons per 24 hours, and from a continuous operation for the last six months, it has been determined that the increased value due to milling exceeds $5 per ton, above the cost of milling.

The company owns and operates a narrow-gage railroad 12 miles long from Jean, the shipping point on the San Pedro, Los Angeles & Salt Lake R.R., to the mine, via Goodsprings, where the mill is situated. Crude oil is used for fuel both on the railroad and for the mill, and costs $1.24 per bbl., f.o.b. Jean. The freight rate from Jean to Utah smelters on this class of concentrate is $6 per ton, and to the zinc smelters in the Mississippi Valley, $8 per ton.

Electrolytic Treatment of Water

By G. D. van Arsdale*

While ordinarily the purifying of boiler feed water must be a cheap operation, there are isolated points at which purification at high expense is still economy. Such was the case at a station on the Eastern division of the El Paso & Southwestern R.R., where a cost of even 50c. per 1000 gal. treated would have given a net saving. Ordinary chemical treatment was out of the question because the water was so hard that if enough lime and soda ash were added for complete softening, enough soluble salts were introduced to give prohibitive priming.

A plant was finally erected to treat 120,000 gal. of water per day by electrolysis of the water between iron plates. The plant ran from October, 1907, to January, 1910. The plant was finally abandoned, as not all waters were amenable to the treatment, and with others the cost was excessive, but it is thought the experience may be of value in other places, even though not a permanent commercial success where it was first tried.

On passing a current between either iron or aluminum electrodes, both the anode and cathode are attacked (the first to a much greater extent), with the formation of a large amount of hydrates of the metal, which detach from the plates and become suspended in the water. On continuing the action for a sufficient length of time, under the proper conditions of voltage, etc., which must be carefully determined for each water, a softening of the water and removal of certain of the dissolved salts takes place, proceeding to a minimum softness, which is different for each case. The action is not entirely understood, but the results show that some waters can be readily softened in this way at an expense which in some places is not prohibitive. The action is probably to be explained partly by occlusion by the hydrates formed, and partly by the fact that lime and magnesia and other constituents are separated by the electrolysis at the electrodes in an insoluble form, being removed with the precipitates which are formed there. A complete removal of the organic constituents also was observed in all cases tested, together with an appreciable reduction in the Cl, and SO_3 ions. In smaller-scale work a complete removal of emulsified oil, and also of bacterial impurities was observed.

These occlusion effects can, of course, be produced equally well by the formation of hydrate precipitates by chemical means, but the method under consideration has the considerable advantage of not introducing anything into the water as a result of the treatment. This is especially important for use for drinking, and as a matter of fact, drinking-water from this plant became popular in the little town soon after its installation, and I know of at least one much smaller plant which has been in operation for a number of years, producing water for sale for drinking and the making of soft drinks, which have a favorable local reputation. The cost of treatment necessary for removing organic constituents and suspended matter is comparatively small, so that in many cases, the method could be used for furnishing an absolutely safe drinking-water supply from doubtful water. After the electrolysis has proceeded far enough, the sludge is removed by filtration or settling, and the water is ready for use.

Most of the following data are adapted from a report made by H. W. Cutshall of the E. P. & S. R.R.: The plant consisted of three wooden tanks, 79 ft. long, 5 ft. wide and about 3 ft. deep. Each was divided into 25 vats of equal size. The tanks were of clear yellow pine, dressed down to 1½ in. The sides were provided with vertical strips, leaving a slot between to allow insertion of the plates, of which 60 were used for each vat. The plates were connected electrically so as to form two multiples of 30 plates each, to each vat, and in wiring four sets of plates in consecutive vats were connected in multiple and these were connected in series with the two tanks on each side. The switches were arranged so that any two of the tanks might be

*Chemist, Phelps, Dodge & Co., 99 John St., New York.

used while the third was being cleaned or filled. The capacity of each tank is 7200 gal., which allowed a treatment to be given to double this amount at one time.

In treating water which showed a hardness of 40 soap test, and with plates spaced 1 in. apart, there was required at the beginning 250 amp. This gradually decreased during the treatment until at the end of four hours it registered 195 amp., the water then showing a hardness of eight. During the treatment bubbles (hydrogen and oxygen) were formed which rose to the surface in the form of foam, and sludge accumulated, partly on the negative plates and partly at the bottom of the tanks. This sludge made it necessary to provide some method of filtration, and a pressure filter was installed which did not prove satisfactory, and was discarded in favor of settling and decantation, although the latter method wasted considerable water. During the treatment it was observed that the corrosion of the plates was rapid where sludge accumulated at the bottom and formed a partial short circuit between the plates, but this could be avoided by altering the design.

ELECTROLYTIC TREATMENT OF WATER

	Treated Grains per	Untreated U. S. gal.	Per cent removed
SiO_2	0.175	0.58	70
$FeAlO_3$	0.175	0.35	50
CaO	1.137	6.85	83
MgO	0.420	1.84	77
Na_2O	0.928	1.19	22
SO_3	2.100	6.75	68
Cl	0.641	0.82	21
CO_2	0.462	4.01	86
Total	6.038	22.39	73

Analyses by Seamon Assay Co.

The original installation with the plates spaced one inch apart was operated for 10 months, when it was found that fully one-third of the plates were so consumed and buckled that it became necessary either to replace or to re-arrange them in order to continue work. During August and September the plates were re-arranged in two tanks, using enough whole plates to space them two inches apart instead of the original one inch, leaving the third tank with the plates spaced one inch. This had the effect of reducing the current consumption in amperes almost half, with results almost as good as with the original installation.

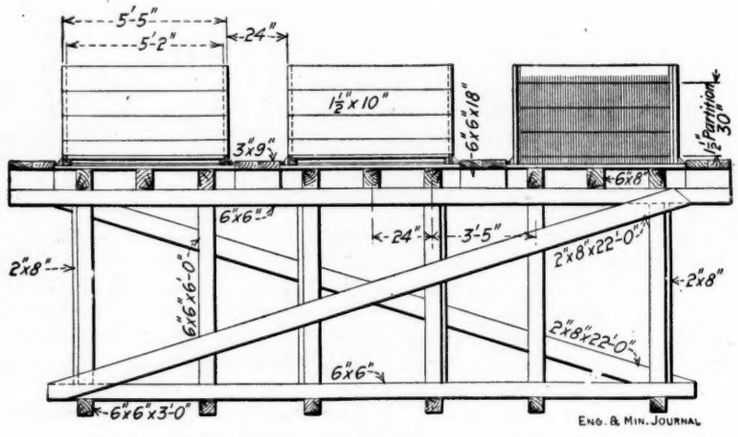
The most serious difficulty in the operation of the plant was the disposition of the sludge, which accumulated in great quantities in the treating and settling tanks. The weight of the plates and their number made it impossible to remove them for cleaning, but after the bottom of them had become eaten away so that the sludge did not form a short circuit, better results were obtained, and the former difficulties from this cause removed, and up to the time the plates were almost entirely consumed little change occurred either in time or conditions of treatment.

Another trouble was the corrosion of the nails used for fastening the side strips, which allowed short circuits between the plate.

The power for this plant was furnished in the beginning at a cost of ¾c. per horsepower-hour, which price was afterward doubled by the power company.

Analysis of the treated water showed that the treatment rendered it a good boiler water, and with modification a plant built on similar lines could be operated much more cheaply by avoiding some of the troubles experienced.

Some data from the operation are given: Total gallons water treated, 42,494,400; cost of electricity, $361,298; cost of coal for pump, $998.97; labor, $5117.50; iron consumed per thousand gallons of water treated, 2.561 lb.; cost of plant not including plates or expense of experiment, $3580; cost of plates per pound delivered, $0.04; weight per plate, 27.6 lb. Analyses of the raw and treated water are as shown in the accompanying table.



ELECTROLYTIC TANKS FOR WATER TREATMENT

Ohio 1911 Coal Output

There were 30,759,986 tons of coal mined in Ohio in 1911 as contrasted with 34,209,668 tons in 1910. That was a high-water figure, caused by Ohio's coal supplying part of the market ordinarily controlled by Indiana and Illinois coal. There were 9530 men on strike in 1911, losing an average of 37 days. The coal mined by machine was 86.5% of the total, while less than 2.8% was shot from the solid.

Iron Mining in New Jersey

A bulletin by Henry B. Kummel, State Geologist of New Jersey, gives the results of iron-ore mining in the state for two years past. The production and values were as follows:

	1910	1911	Changes
Tons mined	521,832	359,721 D.	162,111
Value at mines	$1,582,313	$1,158,271 D.	$424,042
Average per ton	$3.03	$3.22 I.	$0.19

In addition to the decrease in tonnage mined the stocks at mines increased during the year from 17,567 to 115,581 tons, making a total decrease of 260,125 tons in shipments. The production was less than in any year since 1900, when it was 342,390 tons. Some notes on individual mines follow:

"Of the Hibernia group of mines only the Wharton mine was a producer, all of the other openings on this property being idle. At Wharton the Hurd mine was operated, but the Irondale and Orchard were shut down. The Richard mine [Thomas Iron Co.] was actively worked, and its production far exceeded that of any other; indeed, its production was approximately equal to that of its most successful year. Some of the Mount Hope [Empire Steel & Iron Co.] openings were worked and at Oxford the Washington and Ahles mines were producers".

"The Peters mine at Ringwood increased its output, and so did the Hoff mine, near Dover. The Shoemaker mine, near Belvidere, was worked a portion of the year, but was shut down in October, and the High Ledge mine was a small producer for a portion of the year.

The bulletin says: "There are in northern New Jersey vast deposits of magnetic iron ores that are too low in iron for use at the present time, but which can be economically concentrated into very rich material. In many cases the fineness of crushing necessary to secure proper concentration has prevented their use except in a very limited degree."

The Flotation of Minerals

Some further research work is described by Kenneth A. Mickle. Sulphides carrying 0.5 to 5% of adsorbed oil tend to attach gas bubbles, this tendency being greater at the lower limit; oil aids but does not cause gas attachment; acid tends to prevent gas attachment but its action is stronger on gangue particles than on sulphides. Analyses of gases from flotation products show that carbon dioxide is more persistently attached to sulphides than is air. Ferric chloride found to assist in separation of zinc and lead sulphides.

Note—Abstract of a paper by Kenneth A. Mickle, in the Proceedings of the Royal Society of Victoria, Vol. 24 (N. S.), Part II, 1911. Continuation of a previous paper which was abstracted in the Engineering and Mining Journal of Aug. 12, 1911.

Pure water, on being vigorously agitated with air, shows very little tendency to produce a froth. This tendency is much increased by the addition of small proportions of certain substances, not only those which are soluble in water, such as saponine and acetic acid, but some which are insoluble, such as various oils and certain finely divided solid substances.

Frothing Characteristics

Without doubt the phenomena of liquid cohesion are important factors in producing froth, but it seems apparent that gas attachment is the chief factor, and a comparison of the proportions of froth produced would, therefore, afford an approximate measurement of the attachment of air to water and to various aqueous solutions and mixtures.

In the first experiment, one drop of the contaminant was mixed with 60 c.c. of pure water and agitated vigorously with air, the froth produced being noted on the substances rated as follows, in descending order: (1) Saponine; (2) turpentine; residual oil (from rectification of eucalyptol); (3) refined petrol (0.754); acetic acid; (4) eucalyptol; crude shale oil (0.900); cottonseed oil; (5) oleic acid; combustion-engine oil (0.831); (6) shale residue oil; (7) kerosene; (8) alcohol; oil of wintergreen; naphtha; gasoline; ether; petroleum; sulphuric ether; the froth produced by the last members of the series was practically the same as with pure water.

Agitated with air, 60 c.c. of water and 10 c.c. of each substance produced froth in the following order: Saponine; naphtha; kerosene; machine oil; oleic acid; turpentine; eucalyptol; gasoline; alcohol; acetic acid; glycerine (practically no froth).

Each of the various contaminants alone agitated with air, afforded froth in practically the same order as when one drop of the contaminant to 60 c.c. of water was used. The froth produced was, however, less than when water was present. It is difficult to reconcile these three series of results.

It being apparent that the capacity of various mixtures of oil and water after agitation would indicate a measure of the attachment of one to the other, the following observations were made. In each case one drop of the contaminant was added to 60 c.c. of water and agitated with air; after standing, the opacity of the solution was observed: Oil of wintergreen (greatest opacity); turpentine; cottonseed oil; residual oil from rectification of eucalyptol; machine oil; kerosene; naphtha. In the case of the other substances a clear solution resulted. In some cases solutions still showed opacity standing for a week.

When 10 c.c. of the substance was added to 60 c.c. of water and agitated with air, after standing for some time, a layer of white emulsion was noticed between the layer of oil and the surface of the water. This was greatest in the case of machine oil and oleic acid, followed by oil of wintergreen, naphtha, kerosene, eucalyptol and turpentine. The other substances showed no emulsion.

In conducting these tests with oils and water, it was noticed that the following oils spread out as a thin film when one drop was added to the water: Turpentine, gasoline, naphtha, eucalyptol and kerosene. Oleic acid formed a film with one drop, but on adding another drop, the second remained as a globule. The following oils remained as globules on the surface of the water: Cottonseed oil, machine oil and engine oil. This property depends apparently to a large extent on the viscosity of the oil, for, as a rule, with the thin oils a film was formed, while with the thicker oils the drop remained as a globule. Viscosity is not, however, the only determining factor, as some of the more viscous oils were found to form films.

Adsorption of Oil by Minerals

Oils protect minerals from being wetted by water, owing to their affinity for metals and many metallic substances. As no accurate method of measuring this affinity has been suggested, and as minerals may occur in many different forms with varying physical characters, no attempt is made here to make a definite classification on this basis. Tests were, however, carried out to show the amount of oil absorbed by minerals, and to indicate the character of the resultant product. Mixtures of mineral, water and oil (with and without a small quantity of acid) in definite quantities were agitated thoroughly until the character of the resultant product reached a definite standard.

The results of these tests showed that while there are differences in the degree of attraction between a given sulphide and various oils, and between various sulphides and a given oil, the general behavior between various sulphides and various oils in the presence of water is practically the same in character, i.e., all sulphides will become attached to all oils in preference to water. With the silicates and other rock minerals usually found in gangue material of ores, the character of the product varies with different minerals.

In the case of sulphides, bottles were taken containing 200 c.c. water, 5 grams of oil, and 0.5 gram sulphuric acid. Increasing amounts of the sulphides were added to each bottle, which was then well agitated to bring the mineral into intimate contact with the oil.

Tests with Blende

In the first test, blende crushed to pass a 40-mesh sieve was used with a heavy engine oil. With 1 gram blende, on agitating, some of the mineral floated on the solution, being buoyed up by the oil and entangled air bubbles. On standing, all the mineral sank to the bottom of the bottle, carrying large blobs of oil with it. The product formed by the oil and blende was oily and nonmiscible with the solution. An excess of oil floated on the surface of the solution and adhered to the surface of the glass above the level of the solution. With 5 grams of blende, much oil was carried down with the blende, but on standing some of it broke away and came to the surface, leaving an oily mass, nonmiscible with the solution. An excess of oil showed on the surface and adhered to the glass above the level of the solution.

With 10 grams a heavy, freely flowing, oily magma was formed below the solution. Excess of oil still showed on the surface. With 20 grams of the blende, the oily product became more putty-like in appearance, and moved less freely than with 10 grams. An excess of oil still showed on the surface of the solution and on the bottle. With 30 grams a putty-like, plastic mass was formed by the blende and oil, which was difficult to break up on agitation. A slight excess of oil still showed on the surface of the solution. With 40 grams the product broke up into large rounded lumps on agitation. No excess of oil showed on the surface of the solution or on the bottle. On violent agitation a few bubbles of air became attached to the mass. With 80 gm., the product of the oil and blende consisted of a mass of small co-

herent aggregations, which on violent agitation attached many air bubbles, but would not float. With 120 gm., the aggregates of blende and oil were smaller and less coherent. The blende at this stage seemed more prone to attach air bubbles, and showed a tendency to float. The appearance of the product was quite different from a similar quantity of unoiled blende in water.

Galena and Oleic Acid Tests

Another series using galena and oleic acid in similar proportions, showed that the general character of the products was similar to those produced with blende and engine oil. The oily magmas formed on the bottom of the bottles by the galena and oleic acid were less viscous and flowed more freely. A little free oil still remained on the surface of the water when 40 gm. of galena had been added; no free oil appeared with 80 gm. The products with 80 and 120 gm. of galena were more coherent and less prone to attach bubbles of air than was the case with blende. The stage at which small granules formed was less marked with galena than with blende.

In another series with heavy lubricating oil and blende, most of the oil was carried to the bottom with the blende in the form of a putty-like ball when 30 gm. of the blende had been added. This plastic mass would not break up on shaking violently, and was not miscible with solution. With 20 gm. of blende, the product was a thin, plastic mass on the bottom of the bottle, and nonmiscible with water. A large excess of oil remained on the surface of the water. With 40 gm. of blende, the mass showed a tendency to break into small lumps, but had no tendency to attach air bubbles. The lumps were rounded and were about the size of broad beans. No free oil showed on the surface of the water.

In another series, using copper pyrites and 5 gm. of heavy engine oil, all the oil was carried down with 30 gm. of copper pyrites, to form the putty-like magma which would not break upon agitation. When 40 gm. had been added, the magma showed a tendency to break into smaller lumps, but no tendency to attach air bubbles. With 80 gm. of copper pyrites the product was a mass of coherent aggregates under the solution, each aggregate being about the size of fishes' roe. With 120 gm. many air bubbles became attached, producing a marked tendency to float. The aggregates were smaller than when 80 gm. of copper pyrites had been added.

Galena and Other Oils

With galena and kerosene, all the oil was not carried down until 80 gm. had been added. The products were less coherent and less viscous than with the thicker oils.

Using machine oil with galena, little excess of oil showed on the surface when 30 gm. galena had been added, and no excess showed with 40 gm. With 60 gm. of galena the magma showed a tendency to break up, on shaking, and to attach air bubbles.

Using 5 gm. of cotton-seed oil with galena, a small excess of free oil appeared on the surface of the water when 30 gm. galena had been added; no excess with 40 gm. galena. The putty-like magma formed, but was not so viscous as with the thicker oils. No distinct stage occurred at which the oily magma broke up into smaller rounded lumps, as in the case with some of the oils. With 60 gm. a tendency to attach air bubbles was shown and when 80 gm. of galena had been added some of the galena would float, on agitation.

Using a eucalyptus oil containing 80% phellandrene, it was not until 80 gm. of the galena had been added that all the oil was carried down. No distinct "putty" stage occurred, all the oily products being more or less a freely moving pulp.

Tests with Sized Minerals

A series on the same lines as the above tests, but using minerals that had been sized, was then tried. Galena crushed to pass a 30-mesh sieve, but retained on a 40-mesh, was mixed with water and 5 gm. of oleic acid, as in the other tests. With 80 gm. of galena a slight excess of oleic acid still showed on the surface of the water. All the oily products under the surface of the water were feebly coherent, but no distinct putty stage occurred. With 200 gm. a few air bubbles became attached.

Using galena crushed to pass an 80-mesh, and retained on a 120-mesh sieve, with 5 gm. oleic acid, all the oil was carried down with 60 gm. of the mineral to form the characteristic putty-like magma. A small excess of oil showed on the surface of the water with 40 gm. of galena.

With galena crushed to pass 120-mesh sieve, all the oil was carried down by 40 gm. of the mineral. When 30 gm. had been added, the plastic putty-like mass was formed. With 120 gm. of this sized galena to 5 gm. of oleic acid, the product was much less coherent than with 120 gm. of galena crushed to pass an 80- and remaining on a 120-mesh sieve.

Experiments in Unacidulated Water

The foregoing tests were carried out with water acidulated with 0.5 gm. of sulphuric acid. The following is a short summary of the results of tests on the same lines, but using water which had not been acidulated.

Using galena crushed to pass 120-mesh sieve and 5 gm. of waste engine oil (fairly thick), the same general results were obtained as when acid was present. All the oil was carried down with 30 gm. of galena. The putty-like magma occurred when 40 gm. had been added, this product being firmer than that formed with 30 gm. When 60 gm. of galena had been added, the magma broke into granules. With 80 gm. of galena, air bubbles showed a tendency to become attached, and with 120 gm. a marked tendency to float was observed.

Other tests on the same lines, without acid, showed that with smaller proportions of oil to mineral the product was more prone to attach air bubbles and had a more flocculent appearance than when acid was present.

Two bottles containing 50 gm. of galena and 0.8 gm. oleic acid with 200 c.c. water were taken, and to one of them 0.5 gm. of sulphuric acid was added. The appearance and character of the products formed, after agitating vigorously, differed from one another. The aggregations formed in the acidulated solution were less flocculent and showed less tendency to float, on agitation.

Silicates and Other Gangue Minerals

The various silicates and other gangue constituents of sulphide ores, when agitated with various proportions of oil and an excess of pure water, exhibit less tendency to attach the oil than the various metallic sulphides. This tendency to attach oil in preference to water is very feeble in the case of the more acidic minerals, but is so great in the case of the more basic minerals that their behavior approaches that of some of the metallic sulphides. For instance, with 40 gm. of quartz or orthoclase, 5 gm. of oleic acid and 200 gm. of water, nearly the whole of the oil will separate and float on the surface of the water, while the mineral particles sink in the water without any sign of aggregation, a few scattered blobs of oil only being carried down with the mineral. On the other hand, with similar proportions of rhodonite and garnet, oil and water, the minerals unite with the oil to form coherent aggregations, and no oil separates as in the case of quartz and feldspar. Calcite also produces coherent aggregations with oil in nonacidulated water which on agitation readily attach air bubbles.

The addition of small proportions of acid (0.5 gm. sulphuric) to the water in all cases lessens the oil attachment. For example, on agitating the above proportions of quartz and oleic acid with acidulated water, the quartz behaves as if no oil were present; this is also the case with orthoclase.

With rhodonite and oleic acid, in acidulated water in the same proportions as before, free oil separates and floats on the surface of the solution. The product is a sandy pulp which is freely miscible with solution. This pulp has an appearance very different from the product

formed by nonacidulated water, oil and rhodonite in the same proportions. With mixtures of galena and rhodonite, the oil collects the galena to form granules, while the rhodonite remains as a sandy pulp which could be washed out if desired. In cases of a mixture of a sulphide which will attach oil and a gangue mineral which, in an acidulated solution, will not attach oil, some of the gangue mineral is held mechanically by the sulphide aggregates, and thus may be caused to float, although having no natural tendency to do so. In such a case, what may be termed coadsorption may take place. For example, quartz sand by itself will not float with oil in a nonacidulated solution, but the particles of quartz sand in a gangue with other minerals, as in the case of Broken Hill tailings, are readily floated with oil in nonacidulated water. This coadsorption will take place in feebly acid solutions, and thus particles of rhodonite and other gangue may be caused to float.

Adsorption of Oil in Water

From the above tests the following may be deduced:

(1) Finely divided sulphides, when suspended in pure water, will adsorb varying amounts of oil. Large proportions of oil tend to form magma, and smaller proportions plastic masses and coherent aggregates. The character of these oily magmas depends upon the amount and the character of the oil used. Thick oils give viscous coherent products, and thin oils give less coherent products. Oily magmas containing considerable proportions of oil will entangle and hold gaseous bubbles with a degree of persistency which depends on the viscosity of the oil. Sulphides carrying about 5% of adsorbed oil tend to attach gaseous bubbles, and this tendency increases as the proportion of oil diminishes, until a certain limit is reached, which is 0.5% or thereabouts.

(2) Adsorption is more pronounced with sulphides than with such minerals as quartz, feldspar and most of the acidic rocky minerals forming the gangue of ores.

(3) Some of the silicates and other gangue-forming minerals will adsorb oils in a manner approaching that of the sulphides, for example, rhodonite, garnet, magnetite and calcite.

(4) Tests on sized minerals show that the amount of oil adsorbed depends upon the extent of surface exposed.

(5) In acidulated solutions, sulphides will adsorb oil in the same manner to form oily magmas, plastic masses and coherent aggregations, as in the case of water and oil without acid. The amount depends on the extent of surface exposed by the minerals, as previously.

(6) Gangue minerals will not adsorb oils to nearly the same extent as when no acid is present.

(7) The maximum amount of oil adsorbed by sulphides in a stable manner, when crushed to pass through an 80-mesh sieve, is about 10 to 15% of their weight. This is shown by the absence of excess of oil on the surface of the solution in the above tests when the percentage of oil to mineral was at or near these values. The tendency of the plastic magma to break up and form less coherent aggregates at this point also indicates this limit of true adsorption.

Gas Attachments

In my earlier paper it was shown that mineral particles adsorb gases to an extent not previously suspected, and that they retain the gas adsorptions with such persistency that they could neither be easily separated by mechanical means nor much affected by gravity and gas expansion. It was also shown that in the case of adsorptions consisting of a mixture of gases, the respective gases may be separated fractionally, the law of gaseous diffusion apparently not being obeyed. With the view of further investigating these gas adsorption phenomena, the following series of experiments was conducted:

GAS ATTACHMENT IN DIFFERENT WATERS

	Distilled Water	Air-free Distilled Water	Tap Water
Cleaned Foil	A few bubbles collected on the foil, but the foil did not float.	Very few bubbles formed on the foil; when these were detached no more formed.	Foil floated by the buoyancy of the bubbles that became attached.
Uncleaned Foil	Many bubbles became attached and the foil floated to the surface.	A few bubbles formed on the foil, on detaching which no more formed.	Same as cleaned foil.

(1) Pieces of copper and silver foil were cleaned by boiling in a solution of sodium hydroxide, washing in distilled water and drying. These cleaned pieces and similar uncleaned pieces of foil were then placed in a vacuum flask together with (a) ordinary distilled water, (b) air-free distilled water, (c) ordinary tap water, and subjected to a reduced pressure (26-in. mercury). The results are shown in the accompanying table.

On repeating these experiments with the various waters, to which a drop of oleic acid had been added and agitated, in all cases the cleaned and uncleaned foil collected gas bubbles. The uncleaned foil floated and remained floating, while the cleaned foil came to the surface repeatedly but did not remain floating. These experiments show that the persistency of the attachment of gas bubbles is increased when the surface of the foil is contaminated with some oily substance.

(2) Six steel needles were boiled in strong sodium hydroxide solution for half an hour, washed with distilled water and allowed to stand in absolute alcohol for half an hour. They were then dried in a desiccator. The needles would not then float on freshly drawn distilled water. When the water was allowed to stand for some time in an evaporating dish, exposed to the air, it was found that they would float.

Another set of needles and pieces of iron wire similarly cleaned would not float at first, but on being kept in a desiccator for two days would float on the surface of distilled water. Similarly some particles of sulphides when washed with alcohol would not float, but on exposure for some time floated. With a preliminary wash in dilute sulphuric acid, prior to the other cleansing, the behavior of the needles and wire was the same as in the case of the other method of cleansing. This preliminary treatment would remove any oily matter present. When the needles were dried by the aid of a lens and the sun's rays, their floating properties seemed to be improved. If the needles were handled they were found to float much more readily, becoming greasy by contact with the fingers.

Conditions for Flotation of Cleaned Metal

These experiments show that perfectly cleaned needles and iron wire will float on the surface of distilled water under the following conditions, viz: (a) If the water is allowed to stand for some time in contact with the air; (b) if the needles and wire are allowed to remain exposed to the air for sufficient time. In the first case probably a layer of fine dust collects on the surface of the water, and in the second case, probably the attachment of the air becomes greater after a certain time has elapsed.

(3) Cleaned and uncleaned pieces of iron wire on being immersed in a saturated solution of carbon dioxide showed the following results: The cleaned pieces collected very few bubbles on their surface, but the uncleaned pieces were at once covered with a frost of bubbles, and caused to float to the surface. If one of the cleaned pieces were rubbed between the fingers it behaved similarly to the uncleaned wire, and was caused to float.

These experiments also show that gas attachment is enhanced by the presence of some oily material on the surface of the metal.

In order to compare the amount of gas given off from oiled and unoiled sur-

faces the following test was carried out: Two cubical pieces of galena of approximately the same size, with the same extent of surface exposed, were taken, one of which was greased with a small amount of vaseline. The two pieces of galena were then placed under inverted separating funnels filled with a saturated solution of carbon dioxide and standing in a basin of the same solution. Bubbles of carbon dioxide gas were at once evolved from both pieces of mineral. The bubbles on the oiled fragment grew to a larger size, and were held more tenaciously, but more gas was given off from the unoiled piece, as could be directly measured by the amount of solution displaced in the funnel.

Oil Assists But Does Not Cause Gas Attachment

These results show that the oil probably acts as an agent by which the gas bubbles are more tenaciously attached, but that it is the mineral itself which in the first place determines the gas attachment.

(4) Some Broken Hill jig tailings were treated with dilute sulphuric acid, and afterward with water, to separate the whole of the acid. On immersing in a saturated solution of carbon dioxide, bubbles of this gas collected on the sulphide particles, but, except in the case of a few garnet particles, they did not collect on the gangue. On dealing similarly with the same tailings without the acid treatment, bubbles of carbon dioxide collected on all the particles, there being no marked distinction between the sulphide particles and the gangue particles. This shows that the acid treatment tends to prevent gas attachment in the case of gangue particles, while it does not to the same extent prevent attachment of gas to the sulphides.

Analyses of Gases in Flotation Products

(5) Some of the flotation product produced at one of the Broken Hill mines by agitating zinkiferous tailings with an acidulated solution, and a small proportion of oleic acid, was collected, as it came to the surface of the solution. This product was collected in a bottle until the bottle was completely filled, thus displacing the air. The bottle was then stoppered, when the gas contained in the flotation product gradually became disengaged as the sulphide settled down. An analysis was made of this disengaged gas, with the following results: (1) Nitrogen, 72%; oxygen, 2%; carbon dioxide, 26%; (2) nitrogen, 82%; oxygen, 2%; carbon dioxide, 16%. These two samples were taken at different stages in the concentrating operation.

A sample was also obtained of a flotation product made by a process using acidulated solution without oleic acid. The material being treated in this case was Broken Hill slimes, which had been given a slight roast to oxidize the lead sulphide to sulphate in order to prevent the latter from floating. An analysis of the gas disengaged from this product was: Nitrogen, 95%; oxygen, 1%; carbon dioxide, 4 per cent.

(6) The flotation product mentioned in test (5), in which the zinc concentrate was produced by a process using a dilute acid solution and a small amount of oleic acid, was then treated as follows: The concentrate, after being deprived of all visible gas by allowing to settle, was placed in a small flask. The flask was nearly filled with sulphides, 70 gm., and allowed to stand, the slight excess of solution being drawn off. This solution was faintly acid to litmus. The flask was then filled with air-free distilled water, and connected to a vacuum pump, all the connections also being filled with air-free water. On lowering the pressure in the flask, the concentrates were observed to swell, and completely fill the flask, and an evolution of gas was at once apparent. This gas was collected and analyzed; its volume was 1.7 c.c., and it consisted of 58.8% carbon dioxide, 27% nitrogen, and 14.1% oxygen. The flask was then immersed in water, which was brought to the boiling point, at the same time continuing the exhaustion by means of the vacuum pump. An additional volume of 8.9 c.c. of gas collected, consisting almost entirely of carbon dioxide.

A sample of the second product referred to in test (5) was then similarly treated, except that the wet concentrate was made slightly alkaline with ammonia. On heating and subjecting to reduce pressure as before, the gas collected amounted to 18.5 c.c., practically the whole of which was carbon dioxide, only small quantities of nitrogen and oxygen being present.

Carbon Dioxide Has Greater Affinity for Sulphides Than Air

These two experiments show that carbon dioxide still clings to particles of sulphide on settling beneath the surface of the liquid, and after the visible gas bubbles forming the scum have become disengaged. The analysis of the gas disengaged in the previous tests show that it is mainly composed of nitrogen. Assuming that a proportion of oxygen that would give, with the nitrogen found, a mixture corresponding to atmospheric air was originally present, the fact that the gas evolved from the sulphides themselves, when subjected to reduced pressure, is carbon dioxide shows that the latter is attached more persistently than is air.

(7) An attempt was then made to collect any gas that might be evolved from dry minerals on subjecting them to a low pressure. The mineral to be tested was inclosed in a glass flask, and connected with a Toepler pump. The pump was then worked until no more gas could be obtained at ordinary temperature, the last portions of the gas being collected for analysis. The flask containing the mineral was then heated by immersing in a bath of boiling water, the pump being kept continuously working, and the further quantities of gas obtained were collected and analyzed.

Gas Film Not Removable from Minerals in the Dry State

Without describing in detail the method of collecting and analyzing the gas, nor stating in every case the results of the analyses, for which the reader is referred to the original paper, these tests showed that from sulphides and material containing sulphides, such as the Broken Hill tailings and slimes, as a rule more gas was obtained than from calcite and quartz. This gas consisted mainly of carbon dioxide. The residue gas, after absorbing the carbon dioxide and oxygen, was largely in excess of the proportion of nitrogen in atmospheric air, and may have contained hydrogen or an excess of argon. That the carbon dioxide in these tests was not derived from the decomposition of carbonates during the experiment is shown by the negative results on cerussite and calcite.

These results indicate that a concentration or condensation of gas consisting mainly of carbon dioxide occurs on the surface of sulphides, and to a much less extent on the other minerals tested. This gas is held persistently; it does not obey the laws of gaseous diffusion, and may therefore be present in liquid form. This is indicated by the fact that it is the more easily condensed gas, that is, the more persistently attached. The fact that finely divided material in the form of slimes will attach more gas than similar material in a coarser state indicates that the phenomenon is a surface action. It may be akin to the action of charcoal, which will absorb large volumes of the more readily condensible gases as carbon dioxide, sulphur dioxide, and ammonia. It is known that water vapor will cling most persistently to some surfaces even at high temperatures.[1]

In a previous investigation, I found that carbon dioxide was obtained from all sulphides by the aid of heat and exhaustion in the presence of water. It is probable that the gas film can be expanded for removal in appreciable quantities only in the presence of water, and that exhaustion in the dry state does not remove all the gas present. The film can be removed by solvents.

Experiments with Varying Amounts of Oil and Acid

The following series of flotation experiments was carried out to obtain data

[1] "Adsorption of Water Vapor by Quartz," Journ. of Phys. Chem., Vol. IX, 1905, p. 617.

as to the effect of acid on the flotation product when an oil is used. The tests were performed in an enameled pot, with a stirring apparatus attached. The pot was heated from below by a gas burner. The method of effecting the flotation was to add the various materials to the 1400 c.c. of water in the pot, and gradually to heat the mixture, at the same time keeping the agitating propeller working continuously. On ceasing the agitation for a few minutes to let the flotation product come to the surface, this latter was skimmed off with a wire-gauze strainer. After each skimming another period of agitation was given, and in some cases, as noted in the accompanying table, more acid was added, and the flotation product reskimmed. Tailings No. 1 had a gangue consisting mainly of quartz and rhodonite, and those called No. 2 had a more calcitic gangue. In tests 1-10 inclusive, the tailings with the rhodonite gangue were used, and in tests 11-14 inclusive the tailings with the calcite gangue were used. Except where otherwise stated, 1400 c.c. of water were used in each experiment.

The results of the experiments show that:

(1) Without the addition of acid the flotation product made by oil contains much gangue material, and (2) the addition of acid up to a certain point decreases the amount of gangue in the flotation product.

Separation of Lead and Zinc Sulphides

One of the problems to be overcome in the treatment of lead-zinc ores is the separation of the two sulphides into suitable products for subsequent treatment. When these concentrates have been produced from fairly coarse ore, a fair separation of the galena and blende can be made by such appliances as vanners and concentrating tables. With concentrates produced from slime, the separation of the lead and zinc sulphides becomes much more difficult, and cannot be efficiently effected by gravity concentration. One method that has been used is as follows: The mixed sulphides are given an oxidizing roast at a low temperature, which hardly affects the blende, but causes a coat of lead sulphate to form on the surface of the lead-sulphide particles. The product is then treated by a flotation process, the blende floating while the sulphated galena behaves like gangue, and does not float. This is known as the Horwood process.[2]

I have tried various chemical solutions for the purpose of preventing the flotation of galena in such mixtures of sulphides. Some fairly good results were obtained by using a solution of ferric chloride. The action of the ferric chloride causes a permanent and not easily detached coat on the particles of galena. Blende is unaffected by the solution. This white coat formed on the surface of the galena particles consists of sulphur and lead chloride. When the ferric-chloride solution is used hot, the action is quicker. Some oxide of iron, thrown out of solution, is sometimes present in the substance forming the coat when the ferric chloride is allowed to stand on the mixed sulphides for some time. Any dissolved lead is reprecipitated by the sulphuric acid in subsequent flotation operations. The ferric chloride becomes reduced to the ferrous state, and can readily be regenerated if required.

Results with Ferric Chloride in Separating Mixed Sulphides

The results of some small tests on various ores and products follow:

FLOTATION EXPERIMENTS WITH OILS AND ACIDS

No.	Materials Taken for Test	Flotation Product, Grams	Zn., %	Insol. Gangue, %	Residues, Grams	Zn., %	Insol. Gangue, %	Remarks
1	No. 1 Broken Hill tailings, 400 grams; oleic acid, 0.8 gram; water, 1400 c.c.	272	22.4	46.6	119	14.3	39.6	Heated to near boiling point. Agitated repeatedly and skimmed.
2	Tailings, 400 grams; H_2SO_4, 3 lots of 8 c.c. each added	129	49.4	1.4	236	6.3	71.4	First 8 c.c. of acid gave little scum; 2d copious; 3d poor.
3	Tailings, 400 grams; H_2SO_4, 5 c.c.; oleic acid, 0.8 gram	93	46.3	1.1	292	11.0	60	Flotation distinct at 80° C.
4	Tailings, 400 grams; H_2SO_4, 10 c.c.; oleic acid, 0.8 gram	105	46.8	1.2	276	9.8	69	
5	Tailings, 400 grams; H_2SO_4, 15 c.c.; oleic acid, 0.8 gram	109	48.7	1.4	261	8.3	64.6	
6	Tailings, 400 grams; H_2SO_4, 1 gram; oleic acid, 0.4 gram	37.5	48	1.8	354	1.9	49.2	Skimmed and stirred about 20 times.
7	Tailings, 400 grams; H_2SO_4, 2 grams; oleic acid, 0.4 gram	84.5	33	23.2	308.5	17.5	53.6	Skimmed and stirred about 20 times.
8	Same as No. 7 with H_2SO_4, 4 grams	78	40.5	3.2	312	14.3	58	
9	Same as No. 7 with H_2SO_4, 8 grams	77	47.5	1.2	308	12.7		
10	Same as No. 7 with H_2SO_4, 12 grams	80	47.4	1.0	295	12.4	58.6	
11	No. 2 Broken Hill tailings, 400 grams; H_2SO_4, 4 c.c.; oleic acid, 0.4 gram	27.5	36.8	9.0	365	11.4	54.6	
12	Same as No. 11 with H_2SO_4, 8 c.c.	36	43.7	4.8	351	9.7	62.4	
13	Same as No. 11 with H_2SO_4, 12 c.c.	78	45.3	2.2	298	5.0	69.6	
14	Same as No. 11 with H_2SO_4, 16 c.c.	78.5	45.4	0.8	311	4.6	67	
15	Broken Hill slimes, 400 grams; water, 1500 c.c.; H_2SO_4, 7 grams; oleic acid, 0.8 gram	122	31.5	11.0	277	15.1	34.2	
16	Same as No. 15, but with 14 grams H_2SO_4	217	32.2	9.0	166	4.8	54.6	Skimmed about 30 times.
17	Broken Hill tailings, 340 grams; slimes, 60 grams; H_2SO_4, 19.2 c.c., added in 3 lots of 6.4 c.c. each	(1) 38.5 (2) 72	42.9 51.2	2.8 1.0	262	8.4	64.8	The third addition of 6.4 c.c. produced no more flotation.
18	Same as No. 17 but with oleic acid, 0.4 gram; H_2SO_4 added in 3 lots of 6 c.c. each	(1) 75.5 (2) 17.5 (3) 7.5	39.2 46.3 45.7	8.6 2.2 2.4	268	5.8	60.4	
19	Broken Hill tailings, 340 grams; slimes, 60 grams; fuel oil, 1.5 grams; H_2SO_4, added in 3 lots of 6 c.c. each	(1) 122.5 (2) 25 (3) none	38.2 47.9	10.8 5.1	230	18.8	44.6	
20	Broken Hill tailings, 340 grams; slimes, 60 grams; hydrocarbon oil, 0.8 gram; H_2SO_4, 20 c.c., in 5 lots of 4 c.c. each	(1) 7.2 (2) 22.7 (3) 16.8 (4) 8.5 (5) none	35.4 44.9 45.0 48.4	10.6 2.2 1.4 1.2	330	8.3	63.8	
21	Broken Hill crude ore, 200 grams; oleic acid, 0.4 gram; H_2SO_4, 2.4 c.c.	6.4	37.7	4.4	128	6.8	63.2	
22	Broken Hill crude ore, 200 grams; oleic acid, 0.4 gram	(1) 57.5 (2) 69.5	20.6 20.8	29.2 30.6	73	10.9	56	1st float 6 skims. Heated gradually to 80° C. 2d float 15 skims; 20 minutes' agitation.

No. 1—Concentrates produced from an acid flotation on Broken Hill tailings, ground to pass 80-mesh sieve. Fifty grams taken and kept in suspension for half an hour, with 200 c.c. water containing 10 gm. $FeCl_3$, and allowed to stand 18 hours. Refloated with H_2SO_4 and a small amount of oleic acid. Zinc product, 45 gm., floated, 51% Zn, 6.2% Pb; lead product, 5 gm., not floated, 7.4% Zn, 47.6% Pb.

No. 2—Concentrates produced from an acid flotation on Broken Hill slimes, 200 gm. of the mixed concentrate kept in suspension for six hours, with 300 c.c. of a 10 per cent. $FeCl_3$ solution. Refloated with sulphuric acid and a small amount of oleic acid. Zinc product, 169 gm.,

[2] "Treatment of Mixed Sulphides by the Horwood Process," E. J. Horwood, Proc. Aust. Inst. Min. Engr., June, 1911.

51.8% Zn, 5.3% Pb; lead product, 28 gm., 16.7% Zn, 38.1% Pb.

No. 3—Concentrates produced from an acid flotation on another sample of Broken Hill slimes. One hundred grams concentrates stood for 24 hours with 300 c.c. 10 per cent. $FeCl_3$ solution. Refloated with sulphuric and small amount of oleic acid. Zinc product, 67 gm., 48.5% Zn, 8.2% Pb, 25.25 oz. Ag; lead product, 31.5 gm., 7.7% Zn, 46.8% Pb, 13.25 oz. Ag.

No. 4—Crude zinc-lead ore from Tasmania; 200 gm. ore kept in suspension for 45 min. and then let stand with a 3 per cent. $FeCl_3$ solution. Floated the mixed sulphides with a small quantity of H_2SO_4. Zinc product, 77% by weight, 44.8% Zn, 5.7% Pb, 22.6 oz. Ag; lead product, 33% by weight, 10.8% Zn, 41.3% Pb, 9.4 oz. Ag.

No doubt these results could be greatly improved upon under better working conditions and by working on a larger scale. For instance, when working with a deeper flotation vessel, the lighter particles in the lead product have a better opportunity to settle, and are not so likely to be carried over mechanically with the flotation product. On refloating the zinc product, more lead can be separated as an unfloated residue.

Delay in Survey Field Work

WASHINGTON CORRESPONDENCE

As a result of the failure of Congress to pass the regular appropriation bills prior to the first of July, serious delay has been caused in the field work of the Geological Survey. The field men have not been able to get out owing to the lack of money and this has been particularly true of the Alaskan work, inasmuch as it has been customary there for the men to begin operations before the snow had fairly started melting. As things stand, the Alaskan force will not be able to go into the field even under the most favorable circumstances for some little time to come. The result will be an injurious delay in beginning operations even beyond what has already occurred and there will be a corresponding shortening of the season. The difficulty due to failure to act on the appropriations has been serious in all branches of public service that require an early knowledge of the moneys to be placed at their disposal, but it has been particularly injurious in those branches of the service which like the Survey must be prepared to make preliminary arrangements in order to start work on time. The passage of the Fitzgerald resolution will simply extend the appropriations of last year for one month at the same rate proportionally as last year. This will cause some special difficulties due to the fact that in work like that of the Geological Survey the money is not evenly disbursed month by month. The makeshift arrangement seems, however, to be about all that can be done under existing conditions.

Eight Years' Work on the Panama Canal

Under the title "A Summary of Eight Years' Work on the Panama Canal," *Engineering News*, June 27, 1912, epitomizes the progress on this piece of construction. We condense somewhat from their account. Eight years ago the United States assumed the undertaking of building this canal. This was 23 years after work had been inaugurated under De Lesseps, and after nearly $400,000,000 had been expended by the French companies. For their rights the United States paid $40,000,000. This amount paid for some 78,000,000 cu.yd. of excavation and a great variety of equipment, some of which has been in continuous use since, but far more has been sold as scrap metal. Of the 78,000,000 cu.yd. excavated, only 30,000,000 cu.yd. came within the canal prism as it has been constructed.

On May 1, 1912, 171,250,000 cu.yd. of material had been excavated and less than 24,250,000 cu.yd. remained to be removed, which is being done at the rate of 2,500,000 cu.yd. per month. Culebra cut is more than 90% completed. The steam-shovel cut is now less than 17 ft. above the bottom of the channel at Culebra, the summit of excavation. The greater part of what remains to be excavated lies between Empire and Gold Hill, a distance of about two miles. On May 1 the great concrete locks at Gatun and Pedro Miguel were almost ready except for the gates, and the locks at Miraflores were more than 65% completed, with the work advancing at the rate of 20,000 cu.yd. of concrete per week. At Gatun, for the locks and dam, nearly 2,000,000 cu.yd. of concrete have been placed since the work was begun. At the Pedro Miguel locks the total placed is about 840,000 cu.yd. and at Miraflores, nearly 900,000 cu.yd. This makes a grand total of about 3,700,000 cu.yd. The manufacture of the great steel gates was started in October, 1910, and their erection begun the following June. On Mar. 31, 1912, the erection of 58,000 tons of structural steel into 46 pairs of lock gates was already one-quarter completed, a task which entails the driving of 6,000,000 field rivets. The contract for machinery for operating the gates was let in June, 1911, and erection was begun in January, 1912; in May, one gate at Gatun has already been fully equipped and successfully operated. Of the valves which control the flow of water into the lock chambers, two had been put in place on Mar. 31, 43 were ready for erection and the contract for the entire 134 had been let, a total of 1876 tons of metal. The installation of the 120 special cylindrical valves which control the flow of water from the center culverts into the lock chambers is practically completed except for a few in the Miraflores locks.

The erection of the first of the six great emergency steel dams which will guard the upper levels of the locks in case of accidents to the gates has been begun at Gatun and the fabrication of the other five is under way. Each is built essentially of a pair of cantilever trusses, 263 ft. long, so pivoted that their longest arm may be swung across the 110-ft. locks and the wicket girders which form the dam dropped into place. The total weight of the six dams is 12,000 tons. The fender chains for preventing unmanageable ships from colliding with the gates and hydraulic apparatus for operating them are in the process of manufacture at the Boston Navy Yard, and one of them has recently passed a successful test. The fenders for the approach walls will soon be ready to place in position. The electrical apparatus required to operate the locks includes 944 motors, all of 220-volt, 25-cycle, three-phase alternating-current type, and of these 803 have already been contracted for. The contract for the hydro-electric plant at Gatun, which will furnish most of the power for the operation of the locks, has been let and work on the station building will soon be started. The Gatun dam is rapidly nearing completion. The concrete spillway is so far completed as to make possible the closing of the sluice gates, and in the course of a few months Gatun Lake will be at an elevation of 50 ft. above sea level. The west dam at Miraflores has been practically completed. The east dam there is to be a concrete wing wall and has not yet been begun. The work on the west dam at Pedro Miguel is also practically completed. Work on the fortifications to guard the canal was begun during the present year. Besides all this work in constructing the canal proper, almost the entire line of the Panama R.R. has been relocated and the work of rebuilding on the new location is nearly completed. Thus at the end of eight years the end of the great undertaking, without failure in any detail, is actually in sight. Already laborers are being discharged and greatest pressure of work has passed. To accomplish this the United States had expended up to Mar. 31, 1912, $252,000,000, including the payments to the French company and the Republic of Panama.

Alabama 1911 Coal Output

The Alabama coal output for 1911 amounted to 15,018,965 short tons, according to the U. S. Geological Survey, as compared with 16,111,462 tons in 1910. The amount of coal made into coke was 4,417,443 tons in 1910, and 3,129,332 tons in 1911.

Cost of Diamond Drill Equipment

By Heath Steele*

Hand-operated diamond drills may be used for drilling to depths not exceeding 350 ft.; for greater depths drills operated by horse, steam or electric power are required. The first costs of hand and power drills are given.

*52 William St., New York.

Diamond-drill outfits are made in more than 30 sizes and types to suit all conditions. The type of drill required depends upon the work to be performed. Drills are composed in the main of three parts, power, hoisting and drilling apparatus. The motive power may be steam, air, or electricity, and may be applied direct or by belt transmission. A machine may be operated by hand power to drill to a depth of 350 ft.; the same machine can be driven by horse power to drill to a depth of 500 ft. Traction boilers are generally used with steam-operated drills as they can be easily transported.

The Hoisting Apparatus

For shallow holes the hand-power machine requires no hoist, as the rods can be easily raised by passing the rope over the sheave wheel at the derrick head. For greater depths a hand-power hoist or block and fall may be used. With the power-driven outfits, suitable power hoists are provided. The derrick in general use is the tripod, varying in height and weight with the work to be done. For drilling to a depth of 1000 ft. or more, a more substantial derrick is required. Structural steel derricks can be obtained from the drill manufacturers. To construct the tripod, three good poles each not less than 35 ft. long are necessary. These are fastened at the top by a bolt, from which the hoisting sheave is hung. Such an arrangement will give about 30 ft. in the clear for lifting the rods. With all surface drills, wire hoisting rope is furnished with the outfit and is included in the prices herein quoted.

The drilling apparatus consists of various types of swivel heads, or mechanism for rotating the drill and regulating the feed. The feed may be either screw or hydraulic; the latter being commonly used on large drills. A pump is included in the drilling equipment; for the hand-power machine a hand pump is furnished, but with the power-driven machine a power pump is provided. With the steam equipment, one pump will answer for both boiler feed and furnishing water to the drill. The remainder of a drilling outfit is made up of drill rods, couplings, core barrel, bits, carbons or black diamonds, diamond-setting tools, core lifters, water hose, miscellaneous tools, etc.

Cost of Outfit

Machines capable of drilling to a depth of 500 ft. may be divided under three heads: (1) Equipment operated by hand power; (2) equipment operated by horse power; (3) equipment operated by mechanical power. A hand-power drill capable of drilling to a depth of 300 ft. and cutting a $\frac{1}{8}$-in. core, will cost complete for drilling, not including carbons, $578.75; a bit set with carbons, approximately $366; a bit set with bortz about $114. The total price of the outfit and one carbon bit would be about $938.75 and the weight of the outfit, 1850 lb. A hand hoist is included in this outfit. In drilling to a small depth this can be deducted; the price is $35. If only 100 ft. of drill rod is wanted, $130 should be deducted.

A drill capable of drilling to a depth of 350 ft. and cutting a $\frac{1}{8}$-in. core, may be divided into packages weighing approximately 40 lb. each. It is provided with extension screws at the top of the column, and by removing the back braces may be used under ground. The price complete for drilling, not including carbons, is $668.75. The price of bit with stones is the same as above quoted; for complete outfit add the price of the bit. Make the same deductions as above if only 150 ft. of drill rods is needed. The shipping weight is one ton.

A horse-power drill capable of drilling to a depth of 300 ft. and cutting a $\frac{1}{8}$-in. core will cost, not including carbons, $593.75. For the horse-power attachment add $105, which brings the total cost to $698.75. To this must be added the cost of the bit as quoted for hand-power machines. If only 150 ft. of drill rods is required, deduct $130. The shipping weight is approximately 4000 lb. For each additional 100 ft. of drill rod, $65 and 285 lb. should be added. A belt-driven drill, capable of drilling to a depth of 300 ft. and cutting a $\frac{1}{8}$-in. core, but not including carbons, will cost $593.75, to which a power-attachment cost of $65 must be added, bringing the total cost to $658.75. For this machine a 3-hp. gas engine is required. The price of bits must be added to the equipment as in the above cases. The shipping weight is 3000 pounds.

A higher type of machine capable of drilling to a depth of 500 ft., and cutting a $\frac{1}{8}$-in. core, including two bits set with carbons and an 8-hp. boiler will cost approximately $1172.75, and the shipping weight will be about 10,685 lb. For a drill of 1000-ft. drilling capacity and cutting a $1\frac{1}{8}$-in. core, the total cost of equipment including two bits set with carbons and a 10-hp. portable boiler will be about $5064.40 and the shipping weight about 16,205 lb. For a drill capable of drilling to a depth of 1500 ft. and cutting a $1\frac{1}{8}$-in. core, the equipment complete, including two bits set with carbons and a portable boiler will cost $6132.40 and the shipping weight will be about 19,275 lb. These prices are all f.o.b. Chicago. The prices quoted including carbons are approximate only, as the price of carbons fluctuates.

The steel derricks range in price from $125 for a 30-ft. derrick, to $575 for a derrick 63 ft. high. A 63-ft. three-leg derrick can be bought for $425. Shipping weights range from 1500 lb. for the 30-ft. to 5400 lb. for the 63-ft. derrick. In mild climates a roof is all the housing that is necessary; for cold weather a good shanty should be built around the drill and boiler. The cost, of course, will vary according to the cost of labor.

Drilling Costs

The principal items of cost in operating a diamond drill are, labor, fuel, water, carbon wear, repairs and renewals, casing, and depreciation of the outfit. For labor, the services of an expert drill runner are required, the wage paid ranges from $100 to $200 per month according to the place. Two helpers are usually needed on large drills; their wage is governed by the local scale. The cost of one or two teams should be included.

The cost of fuel, water, carbon wear, repairs and the rate of drilling are hard to estimate correctly for a given locality without some past experiences from which data can be obtained. Numerous costs are given as examples, but they lack detail. It is difficult to judge what the cost of carbons will be, as from all available data it is evident that the cost may range from about 30c. per ft. for rock of the hardness of limestone up to $3 or $4 per ft. for harder rock, while for some coal formation it may be as low as five or ten cents.

In the iron districts of Lake Superior, the cost of drilling is reported all the way from $1.50 to $2.54 per ft. It is claimed that near Ishpeming, Mich., drilling was done for 88c. per ft.; however, contractors generally charge from $3 to $3.50 per ft. and it is safe to say that the average cost is around $2.70 for most of this work.

Drilling in the coal measures of Scotland has been reported as high as $7.65 per ft. with diamond wear constituting 42% of the total, and contractors' profit including depreciation at 16.45%. A summary of costs in this country shows that

drilling has been done for $1.60 per ft. in Colorado; $1.63 in Arizona; $1.26 in Tennessee; $1.50 in West Virginia; $3.50 in Nevada; and $2.50 in Mexico. A record of ten holes in the anthracite region of Pennsylvania shows an average drilling rate of 27.9 ft. per shift, at a cost or $1.36 per ft. for holes 375 ft. deep. The rate of drilling for six holes of an average depth of 115 ft., was 22.6 ft. per shift and the cost $1.74 per ft. These figures include all costs and 15% for depreciation and interest on the equipment.

The rate of drilling may be estimated at approximately 20 ft. per shift in a uniform limestone formation, down to five feet in the hardest and irregular formations. The above costs are given to indicate the minimum cost of drilling. It is apparent from statistics on diamond drilling that one must have complete data before any attempt can be made to more than approximate the cost of drilling in new territory. Even with several records of drilling in a given locality, it is possible to find costs varying considerably owing to the same difficulties not being encountered in all holes.

Fire Extinction by Frothy Mixtures

We have already commented upon the extinction of fires in combustible liquids by frothy mixtures (ENG. AND MIN. JOURN., Nov. 11, 1911), but have received many inquiries on the subject and give some additional details. The best results obtained, according to *Engineering*, Jan. 12, 1912, are those in which the compound is a mixture of two liquids which are kept separate until used. One liquid is a soda lye containing froth-forming ingredients (what, we are not informed) and the other is a solution of alum. Both liquids can be exposed to the atmosphere and require only that the water lost by evaporation should be replenished. They both stand a low temperature, as they do not freeze until the temperature goes to 23° F. The system, known popularly in Europe as the Perkeo-Salzkotten and Bartels-Harburg, has been taken up by Henry Simonis & Co. of the Victoria Works, Walthamstow, London.

The results of some experiments on the applicability of this process are reported as follows: 450 kg. of benzine were ignited in the tank 10 m. in diameter. After the liquid had burned 2 min. 15 sec. a jet of the two liquids mixed was applied under a pressure of two atmospheres. The falling foam made the burning benzine splash, but the fire was extinguished in 2 min. 26 sec. Later 15 tons of crude benzine were lighted in the same tank producing an enormous smoke cloud. After the fire had lasted 5 min., the foam was turned on under two atmospheres pressure. In 6 min. the fire was extinguished. About 400 gal. of the two liquids had been used. About 1000 gal. roughly, of foam was left floating on the benzine after extinction of the fire, although two-thirds of the original volume of the original frothy liquid were lost owing to the use of the hose and the exposure of the foam to air and flame.

The experts present at this test concluded that the frothy liquid should be applied under small pressure so that it could spread quietly without causing splashes and eddies which would rekindle the already stifled flame. The number and dimensions of the pipes and hose should be selected so as to insure a quiet discharge of the frothy liquid. In this last case it should be noticed that 10 min. after the fire had been extinguished, on scraping away the foam covering, the liquid would rekindle itself.

Another experiment was with a tar field 1300 sq.ft. in area, the field being covered with 1800 kg. of tar and four empty tar barrels. To start the fire 150 kg. of spirits were sprayed on the surface. After the fire had burned for 4 min. it was assumed that the highly volatile spirits had been consumed and that it was the tar itself which was burning. The hose of a tilting ejector which carries 33 gal. of liquid which mix when the tub, which runs on two wheels, is tilted, was then turned on this burning field. The froth itself issued under a pressure of 3.5 atmospheres and put out the flames in 1 min. 35 sec. The 33-gal. charge was not quite used in extinguishing the tar fire. It would appear from these experiments that large oil and spirit fires can be dealt with by this system and such installations are recommended around petroleum plants, oil and spirit store houses and docks, etc.

According to the *Engineering News*, May 16, 1912, one mixture for fire extinguishing is as follows:

LIQUID No. 1

	Parts by weight
Glue	1
Glucose	¼
Soda bicarbonate	7½
Salicylic acid	½
Water	100

LIQUID No. 2

	Parts by weight
Aluminum sulphate	10
Sulphuric acid	¾
Water	100

Carbon-dioxide gas is generated by the mixture of the soda bicarbonate and aluminum sulphate. The glue renders the liquid viscous and causes it to produce the foam. The salicylic acid is added as a preservative for the glucose, which is intended as a stabilizer to prevent the too sudden precipitation of the aluminum as hydroxide. The sulphuric acid aids in starting the reaction and acts also as a stabilizer. It is possible that it may be found that the acid itself can be omitted and in such an event the corrosive effect of the mixture on the container and piping will be reduced considerably.

Useful Surveyor's Instrument

The instrument known as the rapid traverser was invented in the latter part of the nineteenth century, by James Henderson, an English civil and mining engineer. Accurate work can be done with this instrument, and although it is used in Cornwall for making even the most difficult of surveys, it appears to be little known to American mining engineers.

The rapid traverser may be described as a circular plane-table equipped with a brass alidade that can be revolved. The table is mounted on a tripod. It can be clamped to its support and the alidade to the table by the usual type of clamping screws. A white-enamelled, zinc disk is fixed to the circular table by drawing-pins made of any metal except iron. The alidade is grooved so as to pass easily over the pins. The disk is marked with a series of concentric rings. The fiducial edge of the alidade is notched, so that there is a distance between two notches equal to the diameter of each one of the rings on the disk. Each length or distance between notches is marked with a number indicating to which ring on the disk it corresponds, the object being to permit making several surveys on one disk or to avoid overcrowding of direction lines at any one place.

In use the instrument is mounted on a tripod, the table and alidade being firmly clamped. It is set up over the second station of the survey as at *B*, Fig. 1. and the alidade turned to the first station or backsight *A*. The direction of the first line of the survey, *A B*, is then marked with a sharp-pointed pencil on one of the rings of the disk as shown at the left and at the same time a number or letter is marked on the disk through the notches in the alidade. The alidade is then unclamped, sighted on the third, or forward station, *C*, and clamped again. Then the direction and number or letter of the foresight, *B C*, is similarly marked on the disk.

Three stands or tripods are generally used, one set up at the backsight and the third at the foresight. Having determined the direction of the first two lines of the survey, and having measured their length, the surveyor removes the instrument from the tripod and places it on the tripod at the foresight. The table is then sighted back to the second station and clamped. The alidade is then unclamped, sighted on the next forward or fourth station at which the tripod formerly at the first station has been set up, clamped in that position

and the direction and number or letter of the third line of the survey marked on the ring. In a similar way the direction of all the lines of the survey are taken. In a closed traverse the first line may also be used as the last, in which case the first marks made on the disk should coincide with the last. The disk is then removed from the instrument and the marks on it used for drawing the lines of the survey in making the map.

The magnetic meridian can be taken at any convenient point in the survey by means of a trough compass which is placed against the back edge of the alidade. This with its compass is then revolved until the needle points to zero when the line of the magnetic meridian is marked on the disk. The lengths of the lines, offsets, etc., are taken in the usual way and entered in the surveyor's notes. The sights of the alidade are graduated to give angles of depression or elevation up to 25° and thus the rapid traverser with plane sights can not only be used for all ordinary surface surveys, but for the majority of coal mines and for the levels of metalliferous mines as well. An advantage of the instrument is that the disk can be kept for future reference, the name and date of the survey being recorded upon it, or the magnetic bearings of the lines can be easily read and entered in the usual manner in the surveyor's notes. An easy method of reading off the bearings is to place the disk in the center of an ordinary cardboard protractor cut out for the purpose, the protractor being fastened to the board and the disk fastened in its proper position.

The instrument has been used with success in a military survey in the mountains of Jamaica, and also in British government surveys on the Gold Coast. Fig. 2 shows the system of plotting by this instrument. As an example of surface work a method of setting out railway curves is shown in Fig. 3. The angle of intersection at *O* being read in the field in the usual way, and the distance *OE* chained, the lengths of the chords are calculated therefrom together with their subtending angles. The figure *AEBOCD* is next plotted in the office to any desired scale together with the radiating lines 1 to 6. A zinc disk is then laid down along the figure and the directions and numbers of the radiating lines are ruled upon it. The instrument with the disk attached is then taken into the field and set up at *E*. The alidade is next sighted to *O* or by a backsight to *A* and then unclamped. The assistants in the field are then guided by the observer at *E*, who unclamps his alidade on the radiating lines as shown on the disk in their proper order.

As a further example and one which is interesting from the point of view of its being used in connection with underground work, is the problem of setting out bearings. Fig. 4 shows two parallel veins connected at the 1000-ft. level by a crosscut as shown in the plan. As the ground was treacherous it was decided to drive a new crosscut and connect the levels at the point *A* and *D* driving north and south simultaneously from the respective points. In addition to the pegs *A* and *D* two other pegs were inserted in the "back" at *B* and *C*. The three survey lines were then marked on the disk of the rapid traverser in the usual way and the disk being removed was carried to the office where the three lines were run off on paper in their respective positions and according to their respective lengths as booked. The disk was then laid on the paper, care being taken to place it in its right position, so that any one line on the disk was exactly parallel to its corresponding line on the plan, as indicated in Fig. 5. The bearing *AD* was then run from the plan on to the disk and marked thereon. The disk was then carried underground and replaced on the instrument which was set up at *D*. A backsight was then taken to *C* and the alidade being unclamped was swung on to the line of *A* as marked on the disk. The bearing of the drift to *A* was then set out in the usual way. The instrument was next carried to *A* and being there set up the bearing of the drift to *A* was similarly given and set out. It will be observed that no tedious reading of figures and no calculations were required, the whole proceeding being of the utmost simplicity, and yet, as experience has shown, of the utmost accuracy. The distance from *A* to *D* was of course measured off on the plan.

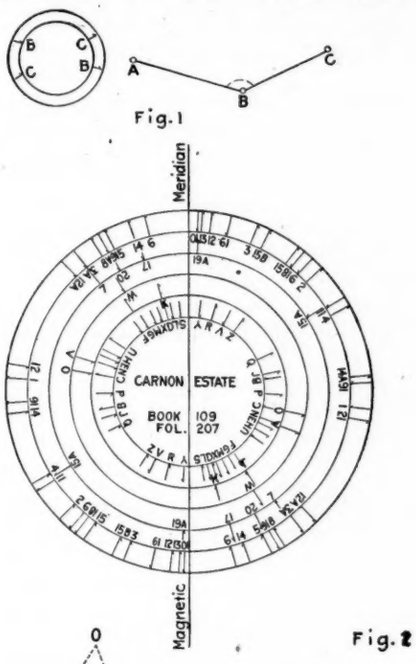


Fig. 2

Fig. 1

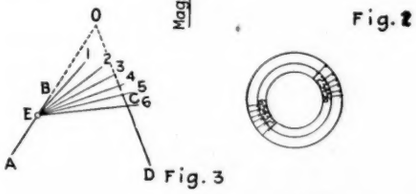


Fig. 3

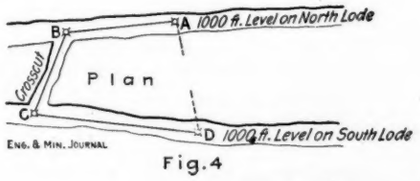


Fig. 4

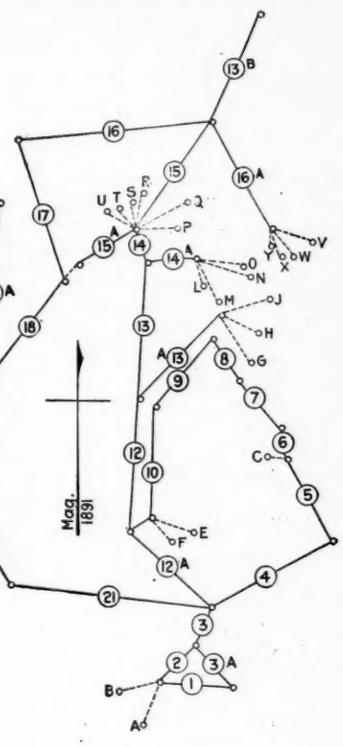


Fig. 5

EXAMPLES OF SURVEYS MADE WITH RAPID TRAVERSE

Wallaroo & Moonta

Notwithstanding gradually decreasing ore reserves, the Wallaroo & Moonta Mining & Smelting Co., operating in South Australia, made a profit of £37,057 for the year ended Dec. 31, 1911. A total of 58,516 tons of material was smelted, from which was recovered 6079 tons of fine copper, 1222 oz. gold and 1400 oz. silver. There were also 182 tons of bluestone, and 4627 tons of sulphuric acid produced. Converters have been installed and the old reverberatories are being dismantled.

Safety in Mine Electrical Installations

The U. S. Bureau of Mines has just issued Technical Paper No. 19, on the subject, "The Factor of Safety in Mine Electrical Installation," by H. H. Clark. The author acknowledges the many advantages that attend the use of electrical machinery in mines, but urges that the requirements of safety as well as those of efficiency be considered when installing electrical mining equipment.

ment in mines are compared to similar conditions above ground and the paper shows that the requirements of mining work present certain difficulties in the way of maintaining electrical apparatus in perfect condition. The effect of roof falls, dampness, dust, and acid water are mentioned and the observation is made that the temporary character of underground work limits the economical investment in electrical equipment and its installation.

The author does not regard the safeguarding of mine electrical equipment as

To quote from the paper: "The safe operation of electrical mining equipment is an engineering problem that involves the element of human life and that is influenced by conditions and events that can not always be foreseen. The successful solution of the problem will, therefore, depend largely upon the factor of safety that is considered in the selection, installation, and maintenance of such equipment."

The paper classifies the electrical accidents that may occur in mines and states the principal sources of danger incident to the use of electricity underground. The conditions surrounding electrical equipment and dwells upon the responsibilities and requirements of such a position.

a simple problem and states that there is no general formula for its solution. It is suggested, however, that a logical first step would be to remove contributory causes by placing lights and erecting guards at particularly dangerous points, and by selecting apparatus especially designed to offset the effect of dampness and dust.

The paper lays stress upon the importance of first-class installation at the outset and frequent inspection of equipment after it is in place. The author considers that a competent electrician is needed to insure the safest and most efficient operation of mine electrical

Data of Russia's Principal Mines and Oil Wells

By V. C. Svimonoff*

The data in the accompanying table have been compiled from the official reports of the Russian Imperial Department of Commerce and Industry and other statistical publications for the fiscal year 1910. The unit of weight used is the pood, which is equal to 36.11 lb. avoirdupois.

American mining machinery manufacturers interested in establishing commercial relations with any of these companies in Russia can obtain detailed mailing lists from the author.

According to Consul Julean H. Arnold there is said to be much graphite in the vicinity of Amoy, and it is anticipated, when mining operations are commenced in that section of China, that the region will be able to supply a considerable quantity of graphite.

*237 Semple St., Pittsburgh, Penn.

DATA OF RUSSIA'S PRINCIPAL MINES AND OIL WELLS

Mineral	Name of Corporation	Annual Output, Poods	Total Annual Income	Number of Workmen	Engine Equipment, Hp.
Gold	Amur Prov.:				
"	G. P. Larin	43.50	$430,000		
"	Upper Amur Gold Co.	135.00	1,225,000	2,437 3,000	12 72
	Irkutsk Prov.:				
"	Lenskoe	520.50	4,890,000	3,835	3,600
"	Promishlennost	120.00	1,100,000	1,420	.....
	Orenburg Prov.:				
"	A. C. Antonoff	26.00	230,000	1,070	220
"	Prince Demidoff	6.50	.....	.....	.....
Platinum	Prince Demidoff	40.00	.....	.....	.....
"	Ekaterinburgskoe	.....	215,000	540	870
Gold	Kochkarskoe	50.00	400,000	3,000	770
	Perm Prov:				
"	Verhne-Issetskoe	30.00	250,000	1,200	560
"	Kyshtymskoe	10.10	160,000	1,442	658
"	P. S. Iakovleff	21.00	205,000	658	.....
Platinum	Platina	28.00	256,000	960	.....
"	Count P. Shuvaloff	69.00	600,000	5,300	544
	Viatka Prov.:				
Copper	Poklevsky-Kozell	3,700,000	200,000	1,200	160
	Ekaterinoslav Prov.:				
"	Aktionernoe	18,000,000	470,000	600	355
"	Aktionernoe on Oihovoi	10,000,000	255,000	200	2,500
Iron	Brianskoe	12,000,000	340,000	420	450
"	V. Galkovsky	15,000,000	450,000	389	295
"	Dubovaia Balka	24,000,000	.....	1,252	975
"	S. N. Kolashevsky	20,000,000	600,000	440	600
"	Nichopol-Mariioupol	10,000,000	300,000	551	36
"	Russian Providence	18,500,000			
Manganese	Russian Providence	500,000	4,500,000	2,500	12,000
"	South Russian Dnieper	8,500,000	.....		
Iron	South Russian Dnieper	31,000,000	620,000	1,496	1,550
	Caucasus Prov.:				
Manganese	Anonymnoe	2,000,000	125,000	200	27
"	Oganezoff Brothers	3,000,000	158,000	600	.....
Lead and silver	Alagyr	1,500,000	2,130,000	950	1,065
Copper	K. Siemens	5,932,000	.....	943	.....

Mineral	Name of Corporation	Annual Output, Poods	Total Annual Income	Number of Workmen	Engine Equipment, Hp.
	Perm Prov.:				
Platinum	K. P. Vorobieff	17.10	$1,900,000	685	40
Asbestos	Korevo Asbest	.....	250,000	560	140
Copper	Count Stenbock-Fermor	1,239,000	245,000	540	196
	Don Prov.:				
Coal and coke	Ruskoe-Gornoe	7,500,000	625,000	2,500	1,655
Coal	V. E. Borjovsky	9,000,000	388,000	625	60
Anthracite	Grooshinsky	13,000,000	670,000	1,178	1,115
"	Grushevsky anthracite	11,000,000	725,000	1,950	1,500
"	N. A. Kolber	5,000,000	235,000	420	238
"	J. D. Kucks	7,500,000	350,000	1,000	500
Coal	Alekseevskoe	30,000,000	1,500,000	3,250	2,015
Coke	Alekseevskoe	12,000,000			
Coal	Auerback	14,000,000	650,000	1,531	1,070
"	Kazakevitch	10,000,000	450,000	350	800
"	South Russian C'al	56,000,000	2,000,000	5,900	4,880
"	Rutchenkovskoe	61,000,000	2,225,000	5,300	4,803
"	Seleznevskoe	16,000,000	655,000	1,540	723
	Irkutsk Prov.:				
"	Rassushin	11,000,000	385,000	220	40
	Petrokov Prov.:				
"	Flora	17,000,000	735,000	1,542	3,439
"	Franco-Russian	12,000,000	1,060,000	2,150	1,257
"	Sosnovitzi C'l As'n	76,000,000	2,500,000	4,200	10,804
"	Saturn	42,000,000	1,750,000	2,189	8,712
"	Cheliadz	32,000,000	1,250,000	1,600	6,750
"	Shen Frantz	7,000,000	300,000	600	565
	Baku Prov.:				
Oil	Uzbasheff	3,000,000	400,000	70	340
"	Adamoff	5,500,000	535,000	.....	.....
"	Aramazd	12,000,000	1,200,000	325	.....
"	Bakinskoe Neftianoe	25,000,000	2,500,000	2,000	8,500
"	Benkendorf	5,000,000	500,000	386	1,640
"	Bibi-Eibatskoe	10,000,000	1,000,000	564	1,550
"	K. V. Bihovsky	20,000,000	2,500,000	45	60
"	K. Zoobaloff	12,000,000	1,100,000	557	1,110
"	Caspian	20,000,000	2,000,000	.....	.....
"	Caucasus Oil	3,600,000	400,000	200	700
"	Caspian & Black Sea Oil	25,000,000	3,000,000	2,000	9,300
"	G. M. Lianozoff	27,000,000	5,000,000	100	78
"	A. Mantasheff	56,000,000	6,000,000	2,300	489
"	Nobel Brothers	62,000,000	11,000,000	13,500	14,600
"	G. Tagieff	23,000,000	2,800,000	250	275
"	Naftalanskoe	8,000,000	850,000	450	1,150
	Tersky Prov.:				
"	Spies Petroleum Co.	12,000,000	1,040,000	860	2,700

Waldemar Lindgren

An announcement of great interest with reference to the reorganization of the geological department of the Massachusetts Institute of Technology was made by President Maclaurin as a part of his address to the students at the recent commencement exercises. When it was announced that Dr. T. A. Jaggar, Jr., is to be director of the Hawaiian Volcano Observatory, and is to reside in the Islands for about five years, it was realized that he could no longer be the head of the department in Boston. The Institute has been fortunate in securing for the vacancy, Prof. Waldemar Lindgren, chief geologist of the U. S. Geological Survey.

Professor Lindgren goes to the Institute not as a stranger, for during two years or more he has been special lecturer on economic geology, so that the authorities have had an opportunity to see and measure him, while he has been able to learn of the Institute's methods.

There is to be established a new chair, the William Barton Rogers professorship of economic geology. This will be a memorial peculiarly fitting to the great Virginian who founded the Massachusetts Institute of Technology. Himself a geologist, he was impressed with the value of economic geology. The more possible is it now to establish such a memorial through the great gift to the Institute of his wife and helpmate, Mrs. Rogers, for the Institute can now afford to lay aside a portion of the bequest for the endowment of the new chair, which it is expected will be devoted largely to research.

Professor Lindgren will also be named head of the department of geology at the Institute. Doctor Jaggar will be director of the observatory as already noted; Dr. Reginald A. Daly will, for the present, remain professor of physical geology; Dr. Charles H. Warren will be advanced to full professorship from associate professor; Dr. Hervey A. Shimer will be promoted to associate professor.

Professor Lindgren, Swedish by birth, has been connected with the U. S. Geological Survey for a long time. He was chief of field parties, becoming two or three years ago chief of the division of statistics of the metals, and six months ago, chief geologist. His work is known everywhere and his writings are voluminous, including several of the huge monographs of the Survey. A treatise on economic geology by him is in press.

The Massachusetts Institute of Technology has heretofore been relatively weak in its instruction in economic geology. It is safe to say that it will no longer be so since its good fortune in securing one of the few American economic geologists of international reputation.

The American Iron & Steel Institute

Preliminary plans are being perfected for the holding of a fall meeting of the American Iron & Steel Institute at Pittsburgh, during the latter part of October. The decision to hold the meeting in that city was reached at the monthly meeting of the directors of the institute at New York, June 28. The Pittsburgh meeting will be in charge of President James A. Farrell, of the United States Steel Corporation, as chairman of the committee on general arrangements, and of Willis L. King, vice-president of the Jones & Laughlin Steel Co., as chairman of the committee on local arrangements. Since May the Institute has received about 300 new members.

Statistical Work

Arrangements have already been made for taking over the statistical work heretofore carried on by the American Iron & Steel Association. The necessary announcements have already been sent to iron and steel manufacturers. Mr. Swank, general manager of the American Iron & Steel Association, who will retire Jan. 1, 1913, will, with his assistants, complete the statistics of all sorts, for 1911, and will also compile the figures of pig-iron production for the first half of 1912, which it has been the custom to issue semi-annually. The outputs of semi-finished and finished steel and other compilations for the year 1912 will be by the Institute under Mr. Swank's cooperation and supervisory attention.

It is the intention of the Iron & Steel Institute officers to issue statistical reports on the industry covering every half-year period in all lines of output.

Developments at Highgrade

Special Correspondence

The Sunshine prospect in the Highgrade district, Modoc County, Calif., was sold to Messrs. Dawson and Fulton, promoters from Los Angeles. Associated with them are the banking interests of Lakeview, Ore. Miners are now breaking ore to make a shipment of 30 tons to the Selby works. Edward J. Trevarrow, who managed the Vindicator mine at Cripple Creek for many years, will develop the Sunshine for the owners. It will be opened by shafts instead of by the tunnel system, which prevails in this district.

The Fort Bidwell Consolidated Mines Co. will have its annual meeting on July 15. General Manager A. J. Cummings stated that the Mt. View and Sugar Pine ground will be worked on company account. The rest of the estate will be leased under terms of 15% royalty and running five years. The 10-stamp mill on this property is being remodeled under the supervision of W. D. French. John Bell, formerly of Stratton's Independence staff at Cripple Creek, will have charge of developing the mine. The preliminary sampling shows about 1000 tons of ore now available for the mill. This ore is exposed on three sides and averages nearly $20 per ton.

There has been some friction between forest rangers and prospectors because of the posting of trespass notices on the cabins, demanding that the owners apply to the Government for the rental of cabins and grounds at a fixed rate to be made known upon application. The snow has about all disappeared and one can easily get into any part of the camp.

California Oil in May

The net production of petroleum in all California fields in May was 6,882,028 bbl. This is an increase in total production over April of 71,075 bbl. but a decrease in daily average production of 5031. The total shipments in May were 6,425,681 bbl., leaving a surplus of 456,347. This is an increase in shipment over April of 834,342 bbl. The fuel consumption in the fields was 422,291 bbl., which made the total gross production for the state 7,304,319 bbl. The record of field development for May in all the fields shows 51 new rigs, 67 completed wells, 5585 producing wells active, 800 producing wells idle, 421 drilling wells active, 362 drilling wells idle; 16 wells abandoned.

MAY OIL PRODUCTION BY FIELDS

District	Bbl.
Fresno County	
Coalinga	1,606,687
Kern County	
Midway	1,885,349
Kern River	947,117
McKittrick	501,936
Sunset-Maricopa	441,494
Lost Hills	112,136
Total, Kern County	3,888,032
Santa Barbara County	
Santa Maria, Lompoc, Cat Cañon	431,012
Summerland	4,350
Total, Santa Barbara County	435,362
Southern Counties and Fields	
Fullerton	481,292
Salt Lake-Sherman	232,005
Coyote-Lahabre	84,732
Whittier	61,853
Ventura	50,301
Los Angeles	31,842
Newhall	9,922
Total southern counties and fields	951,947
Total, all fields	6,882,028

The total stocks on hand amounted to 44,291,423 bbl., of which 27,151,534 bbl. were in the Kern River field.

According to the Cleveland *Iron Trade Review*, the Great Lakes Engineering Works, of Detroit, has booked an order for the construction of a big fleet of self-propelling steel barges, placed by an eastern firm of coal shippers. They propose to operate the barges on the Warrior River, in Alabama, in delivering coal to New Orleans and other ports. The contract price is said to be in the neighborhood of $70,000 each.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Dr. Henry M. Howe sailed from New York for Europe last week.

Henry B. Kaeding, of New Orleans, is in New York for a stay of several weeks.

Alexander P. Rogers, of New York, is engaged in professional work in California.

Dwight E. Woodbridge, of Duluth, has returned from Cuba, where he has been examining several iron properties.

C. W. Wright, who is conducting mining operations in Sardinia, has returned to this country to spend the summer.

D. A. Herron, manager of the Tomboy Gold Mines Co., Ltd., has returned to Telluride, Colo., from an eastern trip.

Frederick Keffer is acting as general manager of the British Columbia Copper Co., in place of E. G. Warren, deceased.

N. H. Emmons, 2d, is in the East on business. His address is care H. Nelson Emmons, John Hancock Building, Boston.

O. F. Brinton, formerly superintendent of the Alpha mine, has been appointed superintendent of the Gold Road mine in Arizona.

Arthur Howe Carpenter, of Denver, Colo., has been appointed research chemist for the American Vanadium Co., of Pittsburgh.

Arthur Houle has been appointed superintendent of mines and smelters of the Shattuck-Arizona Copper Co. at Bisbee, Arizona.

Horace G. Young has been appointed manager of the Trethewey mine at Cobalt, Ont., in place of Charles A. O'Connell, resigned.

A. Burnett, who had been superintendent of the British Columbia Copper Co.'s Emma mine, in Boundary district, B. C., has gone to Cobalt, Ontario.

Walter L. Reid, superintendent of the cyanide plants of the Smuggler-Union Mining Co., has returned to Telluride, Colo., from a professional trip to Oregon.

Hayes W. Young, instructor in metallurgy at Stanford University, California, has been visiting smelteries in Boundary and West Kootenay districts of British Columbia.

Ivan De Lashmutt, for some time past superintendent of a mine in Ainsworth camp, has succeeded W. M. Leete in charge of the Yankee Girl mine, Ymir, British Columbia.

W. Earl Greenough, of Wallace, Idaho, has been elected vice-president and general manager of the Marsh Mining Co., to fill the vacancy caused by the resignation of A. A. Booth.

A. G. Charlton and E. Mackay-Heriot have taken offices together as consulting mining engineers at Mansion House Chambers, 11 Queen Victoria St., London, E. C., England.

Prof. S. B. Christy, dean of the mining department of the University of California, has been reëlected corresponding member of the Institution of Mining and Metallurgy of London.

William Z. Price, mining engineer of the Tennessee Coal, Iron & R.R. Co., at Birmingham, Ala., has resigned to accept a similar position with the Pittsburgh Coal Co., at Pittsburgh.

F. J. Longworth is again superintendent of the British Columbia Copper Co.'s Napoleon mine and stamp mill at Boyds, Wash., after having been several months at the smeltery at Greenwood.

E. A. Thieman has been appointed assistant general manager of the Florence Iron Co., Florence, Wis., and is in charge of the company's properties in Florence, Iron and Gogebic counties

D. N. Muir, manager of the United States Smelting, Refining & Mining Co. in Mohave County, Ariz., and at Needles, California, has removed his office and residence from Kingman to Gold Road.

Jay P. Graves, general manager of the Granby Consolidated company, has returned to Spokane, Washington, from a visit of inspection to the company's Hidden Creek mines, Observatory inlet.

O. E. LeRoy, of the Canada Geological Survey, Ottawa, is in British Columbia, making preliminary arrangements for the visit to that province next year of numerous members of the International Geological Congress.

Corey C. Brayton has resigned as manager of the rock-crushing department of the Natomas Consolidated of California, and will engage in gold dredging in Seward Peninsula, Alaska. His address will be Solomon, Alaska.

OBITUARY

Capt. W. A. Dunn died at Houghton, Mich., July 9. He was well known in connection with the opening of the Baltic lode.

Henry Rhodes died at Jamestown, Calif., on June 13. He was born at Saco, Me., in 1825. He went to California in 1849, and followed mining in Tuolumne County.

Alexander W. Brooks died at Stockton, Calif., on June 24. He was 83 years old. He went to California in the early pioneer days and mined in Tuolumne County. In recent years he was engaged in steamboating.

Graham Pope, one of the pioneers of the Lake Superior copper district, and one of the best known men in the district, is reported dead by a dispatch from Houghton, Mich., July 9. We expect to publish a suitable obituary in our next issue.

J. Douglas Truman, an assistant in the Canadian Geological Survey, who was accompanying Director Brock in an exploration trip in the Rainy River district in Ontario, was drowned in Steep Rock Lake, June 29, in consequence of the upsetting of a canoe. Truman might have saved his life but lost it in rescuing Dr. C. D. Walcott, director of the Smithsonian Institution, who accompanied the expedition and who was in the canoe with him.

E. G. Warren, general manager of the British Columbia Copper Co., died July 4, at Greenwood, B. C., as the result of an automobile accident on June 29. He was on his way from Greenwood to Phoenix and was driving the car himself when it skidded on wet ground, turned over and fell down a steep embankment. Mr. Warren was caught under the car and received serious injuries, but it was at first thought that they were not fatal. The direct cause of his death was a blood-clot which worked its way to the heart. Mr. Warren had been with the British Columbia Co. for a number of years as superintendent of smelters, and in May, 1911, succeeded J. E. McAllister as general manager. He was a capable man and an experienced metallurgist and he had the respect and affection of all with whom he worked.

Societies and Technical Schools

American Institute of Mining Engineers—The next meeting of the Spokane Local Section will be held at Republic, Wash., July 26-28, 1912, invitations having been extended by the City of Republic through the mayor of the city, the Commercial Club, the Mine Owners and by members of the section resident there.

Canadian Mining Institute—The western branch of the Institute held its thirteenth general meeting at Greenwood, Boundary district, B. C., on June 27. Frederic Keffer was in the chair. The annual ballot for chairman resulted in the unanimous election of M. E. Purcell, superintendent of the Consolidated Mining & Smelting Co.'s Center Star group of mines at Rossland, B. C. The chief subject before the meeting was "The Copper Mining Industry of British Columbia," concerning which E. Jacobs, secretary of the branch submitted historical, statistical, and general notes, including copper smelting as well as mining in the province. Other papers were: "Method of Handling Ore on Surface at Center Star Mines, Rossland, B. C.," by M. E. Purcell; "Consolidated Mining & Smelting Co.'s Copper Smelting Department, Trail, B. C.," by Jas. Buchanan; "Copper Mining in the British Columbia Coast District," by W. M. Brewer; and "Notes on Voigt's Camp and Vicinity, Similkameen, B. C.," by Frederic Keffer.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

July 3—The Northern California Mining Co. is in litigation with W. W. Young who has attacked the legality of the election of directors. It is reported that the company admits there were improper votes registered but that they were necessary to prevent others from obtaining control. This company has installed a dredge at Jelly Ferry, Tehama County. It is a suction dredge which is provided with a digger at the end of the suction pump. The experiment is a new one in California dredging and it was expected that this company would prove the adaptability of this character of dredge to the shallow grounds in the northern part of the state. There are a number of tracts of land in northern California that have been proved to contain sufficient gold to warrant the investment necessary to install an inexpensive dredge. But the bucket-elevator dredge of the type commonly used cannot be operated economically in shallow ground, because of the initial cost and the short life of the field. There have been several dredges commonly termed dry-land machines tested in California fields, but there has been no dredge of this character that has yet been generally adopted.

The Southern Oregon & Northern California Mining Congress will be held at Yreka, on July 19 and 20. The congress will draw from all of southern Oregon and a part of northern California. There has been a number of these conventions held but it is expected that this one will attract more visitors and delegates than any of the others. W. H. Storms, State Mineralogist of California, will attend. It will be the first time that the state has ever been represented at these conventions.

Denver

July 5—Notwithstanding the richness of its ores, the La Plata district, in southwestern Colorado, has been little heard of and its camps have been devoid of excitement, but after 30 years of quietude it is suddenly assuming great favor among prospectors and investors, and the old mines are coming into prominence. One of the causes is probably the publicity given the suit between the Idaho and May Day mines, in which two smeltery sheets showed returns on cars of ore ranging from $11,000 to $30,000 per car. Added to this, several noteworthy strikes of high-grade gold ore have been made lately by prospectors in new territory. The district is confined to the vicinity of Durango and Mancos and is reached by the Rio Grande & Silverton, and by the Rio Grande Southern railroads. There is an abundance of timber, water power and cheap fuel, as the principal mines are within two or three miles of the Hesperus coal belt. The gold ores are chiefly tellurides similar to Cripple Creek, and found in lime contacts in the sedimentaries. The Durango Power & Light Co. will extend its lines to the mines from the Rockwood plant, on the Animas River, if the mine owners will guarantee 150-hp. per year, and it is said that this has been assured. The Board of Trade of Durango is raising a fund to advertise the La Plata and Oro Fino districts.

The Federal grand jury has returned indictments against A. E. Minium, W. A. Fisher and S. E. Coler, promoters of the International Asbestos Mills Co., North American Asbestos Co. and Wyoming Consolidated Asbestos Co., all of Natrona County, Wyo., for using the United States mails to defraud. It is said that about $285,000 were received from stock sales and that most of this money went into advertising and to the promoters instead of into development.

The output for the month of June from Cripple Creek was 73,173 tons, worth $1,191,456 in gold. These figures are given by the mills and smelteries.

As already chronicled in the JOURNAL, the Doctor-Jack Pot secured a judgment from the Work Mining & Milling Co., both of Cripple Creek, for ores extracted by the latter from a claim which apexed on the former's ground. Now comes a similar suit, filed by the Roxanna Mining & Tunnel Co. against the Doctor-Jack Pot Co. to recover damages of $1,000,000 for ore illegally extracted.

Butte

July 3—The report of the U. S. Assay Office, at Helena, shows that during June gold deposits from Montana amounted to $188,388, an advance over June, 1911, of $68,976. That the mines in the vicinity of Helena are operating on a larger scale than last year at this time, is shown by the deposit of Lewis and Clark County, which totaled $39,591 in June, 1912, as against $14,634 in 1911. The following is the list of deposits from the Montana counties: Beaverhead, $181; Broadwater, $105; Chouteau, $20,008; Fergus, $52,519; Granite, $100; Jefferson, $150; Lewis and Clark, $39,591; Madison, $70,984; Missoula, $3339; Park, $44; Powell, $1293; Silver Bow, $69.

It is expected that the extension of the Butte, Anaconda & Pacific R.R. will be completed as far as Silver Lake by Aug. 1, and to the terminal at Georgetown, with trains running, by Oct. 1. Three hundred men are on the payroll at present, and one-third of the grading has been completed. Work has been started on the construction of the bridges and steel is being laid on part of the road to facilitate work on a grade. The work of electrifying the road between Butte and Anaconda is progressing rapidly and should be finished by Dec. 1. This work began in the general yards at Anaconda, and the three-mile loop to the smeltery bins was completed first. Work then began on the main line, and had reached a point on the dividing line between Deer Lodge and Silver Bow Counties, near Gregson Springs, June 26, when the whole force of electricians, comprising more than 100 line and ground men, walked out, their grievance being the difference in the scale of wages existing in the two counties. Wages for this work in Deerlodge County, where Anaconda is situated, amount to $4.50 per day, and in Silver Bow, the location of Butte, $5 per day are paid. A request for an immediate increase of 50c. per day was made of the railroad management. Manager Harry Gallwey refused this request at the time, but negotiations are under way at present for an amicable adjustment of the difficulty.

Salt Lake City

July 5—The Utah Ore Sampling Co. purchased the McIntosh sampler, at Park City, June 29. Beginning July 1, the plant will be operated under the new management. It has a capacity of 500 tons per day, and, with the exception of the Silver King Coalition sampler, handles practically all the ores of the Park City district. While the Park City sampler is said to be in good condition, the new company undoubtedly will make improvements, and eliminate numerous small complaints made against the former management by producers. The Utah Ore Sampling Co. was formed two or three years ago to take over the Taylor & Brunton mill, at Murray, the Pioneer sampler at Sandy, and the Silver City mill at Tin-

tic. Jesse Knight is president and A. W. Gates is general manager.

There is some dissatisfaction among mine owners with the present system of state taxation. The mine owner must pay an income tax to the government in addition to state taxes on the property, improvements and net proceeds. The net-proceeds tax is criticized, owing to the incompleteness of the law as to what shall be deducted as legitimate expenses in reaching the item of net proceeds. Taxes cannot be deducted, nor fire, nor liability insurance, nor damages paid through injuries of employees, nor legal expenses, in deriving the net-proceeds account. It has been suggested that the board be given wider discretion in the matter of mine taxation, especially in the taxing of idle or unproductive properties.

The regular meeting of the Utah Society of Engineers was held June 21, in the Newhouse Building. The proposed modified form of the constitution was presented by Pres. R. K. Brown and the executive committee. One of the principal features of the new constitution is the provision for associate and junior members, as distinguished from regular and honorary members. By this, junior members, such as students, will be given all the privileges of membership except the right to vote and hold office. This applies to associate members also. Prof. R. R. Lyman was to have read a paper on "The Use of Weir Measurements of the Flow of Streams," but was able only to give a brief outline of the subject, on account of the time consumed in discussing the modification of the constitution. The entire paper will be given at a later date. The amendments to the constitution will come up for final disposition at the next meeting of the society, in September.

Lovelock, Nev.

June 29—The Salt Lake smelting companies are searching Nevada for suitable smelting ores that will flux well with the Utah ores, seeking especially those with an iron base. The California smelters are offering special rates for siliceous ore, so that the position of the ore producer in Nevada is such as to command the best rates on either iron or siliceous ores, the freight being the most important consideration. This will, perhaps, soon create a condition that may invite smelters to build somewhere near the center of the state, where an industry of good proportions might grow up.

Miami, Okla.

June 30—The mills at present under construction in the Miami district are as follows: Thirty-acre Mining Co.'s mill, L. C. Church, manager; Chapman & Lennan, Temple Chapman, manager, Webb City, Mo.; J. H. Malloy's mill, R. H. Danford, manager, Miami; Prairie Mining Co.'s mill, Samuel Sullivan, manager; Miami Royalty Co.'s two mills, J. F. Robinson, manager, Miami. The above are second-hand mills and are being moved from other leases in the Joplin district. In all except one, Bessemer gas engines are being installed for driving, with power varying from 135 to 150 hp.; Bessemer gas engines are also being installed to drive the air compressors for drills and hoists. The compressors are mostly Rand-Imperials.

The Chapman mill is being tuned up and the 30-acre mill was expected to be running by July 1. The remaining four companies have purchased mills and have commenced to dismantle and move them. The average cost of these second-hand mills, moved and rebuilt, is from $12,000 to $15,000; the average capacity is 300 tons per 24 hours.

The Carson-Dodson Mining Co., L. C. Church, manager; Chapman & Lennan Co.; Miami Royalty Co.; and George Moore, of Webb City, Mo., are planning the erection of four more mills this autumn, but have not purchased them as yet. In all probability these will be second-hand mills also, as the latter can be purchased, moved, remodeled and rebuilt for about 50c. on the dollar as compared to a new mill.

Negaunee, Mich.

July 6—One of the best advised companies in this field is the E. J. Longyear Co., of Minneapolis, which has recently made an extensive find near the Mastodon mine, southwest of Crystal Falls. This company, which has absorbed the old Longyear & Hodge Co., of Marquette, has lately turned its attention from Minnesota to Michigan, and under the direction of an experienced geological staff, of which W. J. Mead, of the University of Wisconsin, is the head, is investigating iron-ore possibilities in a systematic manner; it is reported that the Longyear company will send out four geological parties in the Michigan region this summer. Northwest of Iron River attention has lately been directed to the Atkinson region and its possible connection with the Amasa district, while diamond-drilling near Watersmeet on the Chicago & Northwestern Ry., has suggested the possibility of an extension of the Iron River district into Wisconsin, south of the Gogebic Range.

Sudbury, Ont.

July 5—The Dominion Nickel-Copper Co., controlled by the Booth-O'Brien interests, of Ottawa, has purchased the Murray mine, which formerly belonged to the Vivan interests, of Swansea, Wales, and has also purchased some holdings of the Lake Superior Corporation, including the Elsie and Gertrude mines on the south range and the Victor on the north range. The company is already the owner of extensive nickel properties in this district, having acquired the interests of a Hamilton, Ont., syndicate, on the north range, three years ago.

The Dominion company has been carrying on exploration and development work for the last two years and is continuing it. It is expected that the company ultimately will erect a treatment plant at Sudbury and enter actively into nickel production. J. A. Holmes is the local manager of the Dominion company. Operations which were commenced last year by an English-German syndicate and also by Toronto men, have been permitted to lapse, with some sporadic drilling.

The Canadian Northern Ry. is building its trunk-line extension through the northeast corner of the Sudbury district and will furnish access to a number of properties that heretofore have not been available. The Manitoulin road will be completed to Little Current this season and will furnish direct connection between Lake shipping on Georgian Bay, and the Sudbury district.

Cobalt

July 5—Judge Demers, of Montreal, has dismissed the action brought by a number of the original shareholders of the Crown Reserve Mining Co., of Cobalt, to compel its trustees to distribute among them stock held in trust. This stock was not distributed when the original allotment of shares was made but was held back for future distribution to provide funds for development when needed. The claimants are no longer members of the Crown Reserve syndicate but they contended for the right to have the stock shared among them.

Porcupine

July 5—Considerable interest has been aroused here over the starting of the Porcupine Gold Mines Co.'s mill, as it is a radical departure from the general practice throughout the district. The mill, which is designed for a capacity of 100 tons per day, uses crushers and rolls for the preliminary crushing, and 4½-ft. Hardinge ball mills, instead of stamps. The pulp from the ball mills is classified, the oversize being returned to the mills, while the undersize goes to 6-ft. Hardinge pebble mills. The pulp from the pebble mills, over 95% of which will pass 100 mesh, goes direct to the amalgamating plates. No cyanide or concentration is attempted but it is expected that by having a large plate area, and by careful amalgamation, a saving of 85% will be effected. The tailings are being stored in case it is desirable to cyanide them later. The mill has been in operation only a short time but the results obtained to date are satisfactory. The development of this type of mill is important as the low initial cost, cheapness and simplicity of operation commend it for many mines.

The Mining News

The Current History of Mining

Alaska

Press dispatches from Fairbanks state that the most violent earthquake ever known in that vicinity occurred on July 6, the shock lasting continuously for 40 sec. Louis Anderson, foreman of a mine on Dome Creek, is reported to have been killed by a fall of ground, loosened by the shocks.

Alaska-Treadwell—This company is installing a power station at Nugget Creek, 15 miles from Juneau and has 90 men employed.

Alaska-Mexican—During May, 20,517 tons of ore were crushed, yielding $60,-618 gross and net $20,868. Operating expenses were $29,652; construction, $10,096. Development totaled 147 ft. and the ore averaged $2.98 per ton.

Alaska-United—During May, 39,424 tons of ore were crushed, yielding $99,-052 gross and net $23,055. Operating expenses were $54,363; construction, $21,-633. Development work totaled 834 ft. The ore averaged $2.72 per ton at the Ready Bullion mill and $2.37 at the 700 Claim.

Arizona

Cochise County

Commonwealth—The matter of building a mill at the mine is still being considered by the Montana-Tonopah Mines Co., of Tonopah, Nev., the owner. It is stated that tests are being carried on by copper smelters looking to the use of Commonwealth ore for converter linings. It is expected to know within three months whether a contract can be made with the smelters for 300 tons of ore per day, in which event the construction of a mill will be unnecessary.

Gila County

The larger mines of the Miami district are gradually supplanting horses with motor trucks for hauling supplies from Miami to the mines. The Inspiration has a 3½-ton Alco, a 2-ton Velie and a 1500-lb. Velie. A 3-ton Velie is hauling supplies to the Live Oak mine and the Miami Copper Co. is using a 1500-lb. Velie.

Copper Reef—A second shaft has been put on at the mine, 12 miles south of San Carlos, and 22 men are now employed. The California tunnel is in 1095 feet.

Inspiration Consolidated—Charles E. Mills, general manager, has arrived in Globe, to assume charge of operations. He was accompanied by W. H. Aldridge, Dr. L. D. Ricketts and W. D. Thornton. Over 500 men are employed. It is intended to sink the main west working shaft 1000 ft. for the extraction of ore from the Live Oak orebody. The new Ingersoll-Rand compressor, of 1200 cu.ft. capacity, is in operation at the portal of the Inspiration tunnel and development of that orebody is progressing rapidly. New dwellings are being erected and grading is being done for the pumping station.

Miami—Preliminary figures give approximately 2,700,000 lb. as the production for June. There were mined 89,900 tons of ore during the month. One churn-drill is at work at the northeastern part of the property and a Sullivan diamond drill is in operation on the 570-ft. level. Manager B. B. Gottsberger states that the future policy will be to make public no more information on results of diamond drilling.

Old Dominion—The smeltery produced 2,112,000 lb. of fine copper in June, with an average of 2½ furnaces in operation. It is expected that three furnaces will be working in July as the amount of custom ore received is gradually increasing.

South Live Oak—Churn-drill hole No. 1 has been discontinued at a depth of 825 ft. without discovering ore. The drill is being moved to another site where it is proposed to drill on a faulted zone in the granite formation.

Rose—John Rose reports the discovery of copper-silicate ore in a 100-ft. tunnel in diabase on this group of nine claims north of and adjoining the Inspiration.

Mohave County

Banner—Two cars of ore have been shipped to the Needles smeltery by leasers on this mine. This shipment is said to average about 60% lead and $40 per ton in gold and silver.

Frisco—Manager E. H. Barton recently brought in a $6000 bar of bullion. This was the cleanup of two weeks' milling. The company is handicapped by its present mill equipment, the capacity of which is small for the amount of ore developed.

Boundary Cone—A strike of high-grade ore was reported recently on the 400-ft. level. The shaft is now being sunk to the 500-ft. level.

Arizona Southwestern Copper Co.—This company has two Avery auto trucks operating between Yucca and Copperville, one of three-ton capacity and the other of five. L. Hoffman, manager, states that a Saurer truck will also be placed in service soon. The structural material and the machinery for the mill are being delivered and construction is under way. The use of reinforced concrete for the sides of the building, is being seriously considered.

Mitchell—The shaft is being sunk to a depth of 500 ft. At present 35 men are on the payroll. Joseph Onetto is in charge.

Tom Reed Junior—The main shaft has reached a depth of 220 ft. and it is reported that it has been in milling ore from the surface.

Iowa—John H. Moore has a contract for sinking from the 200- to the 300-ft. level on this group. Ore running over $100 per ton has been encountered at a depth of about 240 feet.

San Francisco—Shaft sinking is still in progress under the direction of Clifford Goulding. The property is owned by the Yucca Mining Co., whose president, T. J. Purdy, of Sunbury, Penn., was in Kingman recently. A diamond drill will be used to assist in prospecting.

Yuma County

Clara Consolidated—This mine and smeltery at Bouse was recently examined for European interests that have an option. The property was financed and developed by George Mitchell but has been closed for about a year. It is reported that new interests will develop the mine and resume smelting operations.

California

Amador County

Kennedy—Preparations are made to deepen the 3500-ft. shaft to about 3700 ft. This is still the deepest vertical shaft in the state.

Keystone—This corporation has issued its financial report for the half year ended June 18, showing an expenditure of $28,-771. The chief items are: Power, $2594; equipment, including compressor and blower, $6210; lumber, $3676; labor, $12,685; supplies, including powder, $945. The balance, $2661, covered office and legal expenditures. The inclined shaft has been unwatered, repaired and deepened to 1700 feet.

South Eureka—The deed transferring the Oneida mine and 250 acres of adjoining land to this company has been recorded. The company for several

months has been reopening the Oneida and putting the 80-stamp mill in order.

BUTTE COUNTY

The Lumpkin district, 32 miles east of Oroville, is attracting attention. The Triumph has placed a stamp mill in commission, and a good cleanup was recently reported. The Richards and Sparks mine is reported to have encountered good ore.

CALAVERAS COUNTY

Petticoat—The new gallows frame is up, a 50-hp. Nagle engine installed, the new assay office completed and the shaft retimbered to the water line. The Afterthought shaft will be connected with the Petticoat at the 450-ft. level.

Comet—The 10-stamp mill is in commission and is running on high-grade ore.

Channel Mining Co.—A Dodge rotary pulverizer has been installed at this gravel mine, at San Andreas. D. A. Cavagnaro is superintendent.

Lloyd—This gravel mine, at Central Hill, has been redeemed from delinquent tax sale. The litigation causing the sale is being cleared, preparatory to reopening the mine.

Calaveras Copper Mining Co.—Reports state that the concentrator will be in commission about July 15.

ELDORADO COUNTY

Georgia Slide—It is reported that the Sacramento men who bonded this old hydraulic mine and were working it with a Beers mill, have relinquished the bond, and that the property is being operated by the owners.

Bright Hope—Work has been resumed at this mine, near Georgetown. The installation of a stamp mill is contemplated. J. N. Lawson is president.

GLENN COUNTY

Some excitement has been caused at Willows, by the report that there is gold in the gravel of Stony Creek in the vicinity of Stonyford.

MARIPOSA COUNTY

Original—The inclined winze, 185 ft. from the portal of the tunnel, is being deepened from the 160-ft. point. At 200 ft. depth the vein will be drifted on both north and south. The mine is equipped with an electric power plant, situated on Merced River. The electric current is generated by two Leffel wheels under a 24-ft. head. A 2-stage Ingersoll compressor is driven by a 133-hp. Westinghouse machine. Timber and machinery are on the ground for the construction of a 10-stamp Joshua Hendy mill of 1000-lb. stamps. Pacific vanners will be installed, built by the D. D. Demarest Co., of San Francisco. The Yosemite Valley R.R. provides transportation at El Portal. George W. Egenhoff, of Merced, is superintendent.

NEVADA COUNTY

Pittsburgh—The drift on the 1500-ft. level has been connected with the winze. The winze will be deepened 250 ft. Mark B. Kerr, Nevada City, is manager.

PLUMAS COUNTY

Droege Mining Co.—Contracts have been let to the Indian Valley Electric Light & Power Co. for power for this mine, at Greenville, to be available in September. A temporary 250-hp. steam plant will be installed for present use, and will be maintained as an auxiliary. E. O. Lindbloom is manager.

SHASTA COUNTY

First National Copper Co.—The company is reported to have sold its coke supply of 1000 tons to the Mammoth company. This may indicate that there is small hope of resuming operations soon.

SIERRA COUNTY

Telegraph—The company intends to erect a new power plant this summer, with a capacity of over 1000 horsepower.

Colorado

CLEAR CREEK COUNTY

Hoosac—The company is advancing its tunnel 150 to 160 ft. per month toward its property, on Quartz Hill. The tunnel is 8x8 ft., and its total length is 2000 ft. No. 8 Leyner drills are used. H. C. Perks is superintendent.

Lalla—This property is operated under lease by F. C. Dinsmore. The 10-stamp mill has recently been started. It is reported that the mine contains a broken reserve of gold-quartz ore, sufficient to supply the mill for more than a year.

Freeland—A meeting of stockholders is called in Idaho Springs, on July 9, to consider the question of providing funds for payment of the company's debts and for additional development. If the debts are not paid, the property will be sold by the sheriff on July 10, to satisfy an $83,790 judgment.

LAKE COUNTY—LEADVILLE

Surface water from melting snow and late heavy rains has stopped work in many shafts, besides making the roads so bad that the haulage of ore has been seriously hindered and prospecting in the outlying sections has also been interfered with.

Yak—Thirty sets of lessees are at work in the long tunnel and most of them are shipping. The monthly output is about 12,000 tons.

Big Chief—Fifty tons of carbonate-of-zinc ore and 50 tons of lead and iron ore per day are being shipped.

Little Miami—A good grade of iron ore, carrying gold, silver and copper has been shipped from the 400-ft. level by lessees in the Big Tom shaft.

Long & Derry—Lead-carbonate ore is being shipped from the 260-ft. level of the Estey shaft.

Bertha—Lessees are shipping 2-oz. gold ore, but work in the lower levels is being curtailed by the influx of surface water.

LA PLATA DISTRICT

Another discovery in the La Plata Mountains, in southern Colorado, is announced, and it is said that excitement prevails; many of the farmers in the Farmington section are said to be leaving their fields for the gold district, and the stages between La Plata City and Hesperus are crowded. Most of the ore in that district contains principally gold, but this discovery shows a vein that assays high in silver. Shipments have commenced.

SAGUACHE COUNTY

Rawley Mining Co.—During June the 7x8-ft. development and drainage tunnel was driven 488 ft., of which 92 ft. were driven during the last four days of the month. During the early part of the month, considerable hard, altered andesite, heavily impregnated with iron pyrites, and carrying much water, was encountered, making progress slow and difficult. On June 1, the tunnel was in 4684 ft. and it is expected that the total length of 6250 ft. will be completed in about three months. W. C. Russell, Bonanza, is manager.

SAN MIGUEL COUNTY

Nellie—This mill, near the head of Bear Creek, is equipped with stamps and amalgamating plates and until recently no attempt has been made to treat the tailings. A lessee has now installed two Wilfley tables to do this. Preliminary results have been satisfactory.

Ballard—Seven men are at work on this property, on Ballard Mountain, taking out ore for a test mill run. It is reported that the vein contains gold-bearing quartz, 3 ft. thick. Some of the ore shows native gold.

TELLER COUNTY—CRIPPLE CREEK

The old Rosebud mill, near Mound City, was burned down in 1893, and the tailings are now being shipped to the Golden Cycle mill, at Colorado City, yielding from $8 to $15 per ton.

Stratton's Independence—During May, production amounted to 3071 tons of ore averaging $15.25 per ton. Low-grade mine and dump ore amounting to 10,900 tons was milled. Special development cost $1550 and net profits at mine and mill were $14,500.

Elkton—On the 1100 level the main oreshoot has been opened and shipments show that the ore is richer than in the levels above. It is stated that there is enough in sight to produce 3000 tons per month for five years.

Old Gold—The shaft on Beacon Hill has been repaired and will be sunk 200 ft. from the 600 level.

Free Coinage—A rich strike is reported in the Pinto mine, at 450 ft. depth. J. B. Neville is general manager.

Findley—The output during June was eight cars of $25 ore. A crosscut is being driven from the 1500 level toward the Hill City claim, in which it is expected to cut shipping ore.

Specimen—This mine has three feet of ore, which ships at $30 per ton with little sorting. The output is five cars per week.

C. K. & N.—On the Rapp vein an oreshoot of rich telluride of gold has been found. A new drift is being run now from the 900 level in a cross vein which produced rich ore some years ago, and which is now rendered possible by the deep drainage tunnel.

Ocean Wave—A 6-ft. vein of ore is reported found. A shipment gave returns of $22.50 per ton and two cars per week will be sent out.

Idaho

Coeur d'Alene District

Ca'edonia—Boise dispatches state that suit has been filed against this company by the Bunker Hill & Sullivan Mining Co. The Caledonia recently opened an oreshoot, and the Bunker Hill & Sullivan's claim to this, below the 500-ft. level of the new mine, is based on the apex law.

Michigan

Copper

New Arcadian—The new shaft has reached bedrock, having passed through about 40 ft. of overburden. Diamond drilling is being done at various points on the property in the horizon of the Baltic lode.

Mass—Construction work at "C" shaft has been completed and ore shipments started. Production will be temporarily handicapped owing to the scarcity of underground labor that prevails throughout the district.

Houghton—Developments on the Superior lode at the 600-ft. level are continuing satisfactory. The ore that is being accumulated in the stock pile is rich and plans are being formulated for an extended mill run. The surface equipment includes an electric hoist and compressor.

Indiana—Shaft sinking is going forward and has reached a depth of over 1000 ft., in a trap formation. It is calculated that the felsite formation will be reached at a depth of about 1300 feet.

Adventure—Drifting is being done on No. 3 lode with encouraging results. The formations have been opened by a crosscut from the 1500-ft. level. No. 1 lode carried little copper and openings on No. 2 show the formation to be bunchy. The shaft is temporarily bottomed a few feet below the 1500-ft. level.

Onondaga Copper Co.—This company was recently organized with a capitalization of 150,000 shares. Reginald C. Pryor is president. The company starts out with $120,000 and 45,000 shares of stock in the treasury. It will explore and develop about 10,000 acres of land in Ontonagon County, in proximity to the White Pine tract of the Calumet & Hecla. Diamond drilling will be started soon; sufficient preliminary work has been done and Mr. Pryor has enough geological data to enable him to lay out a drilling campaign.

Naumkeag—Diamond drilling is reported to have started. This property lies west of the village limits of Houghton and is believed to be traversed by the Pewabic, Hancock and other lodes.

Mohawk—This company is asking for bids for the erection of a modern steel shaft house, for No. 6 shaft.

Iron

Republic—Shipping by steam shovel from stockpiles has been active at the company's shafts and the piles will probably be cleaned up this season. At No. 9 shaft, vertical, a new steel headframe is planned to replace the wooden one.

E. J. Longyear Co.—This Minneapolis exploration company is drilling in northern Wisconsin, near Watersmeet, Mich., for Frederick I. Carpenter, of Chicago, and associates, large owners of land and mineral rights in Wisconsin and Michigan. It is thought that there may be an extension of the Iron River district into Wisconsin, south of the Gogebic Range. The area to be explored extends from the Lake Vieux Desert, of Gogebic County, Mich., through Villas County, Wis., as far as Powell and Emerson, in Iron County, Wisconsin.

Yale—This mine at Bessemer has been shut down. Two months will be devoted to repairing the shaft. On July 1, the intention was to close the company's blast furnace at Ashland, Wis., for repairs.

Florence Iron Co.—This company, which has been drilling at Commonwealth, Wis., will sink an exploratory shaft near the school house there. It is planned to sink 300 ft. and drift on two levels. E. A. Thieman, formerly bookkeeper in the company's office at Florence, has been appointed assistant to Felix Vogel, general manager, and will have charge of the Ladenburg-Thalman operations in Florence County, Wis., and Iron and Gogebic Counties, Michigan.

Corrigan, McKinney—The Colby and Ironton mines at Bessemer are active. Each mine produces two high-grade, non-bessemer ores.

Missouri

Mine La Motte—After being in operation intermittently for nearly 200 years, this property is reported to have been closed down recently, following labor troubles. It recently passed into the hands of a St. Louis promoter but has been troubled with financial difficulties.

Montana

Butte District

Butte-Duluth Mining Co.—On June 27 this company was incorporated by Butte men, with a capitalization of 25,000 shares, par $10. The incorporators and directors are Alfred C. Kremer, J. B. Kremer, L. P. Sanders, W. M. Tuohy and C. M. Everett.

Beaverhead County

Butte & Vipond—Considerable development work is being done at the Martin mine near Dewey. The work is confined to the 200-ft. level, where crosscutting and drifting are in progress. A. J. McIntyre, who is in charge of operations there, has been in Butte arranging for the purchase of machinery and mining supplies, and after the former is installed the force will be increased.

Deerlodge County

Gold Coin—L. F. Ireland has an option on this group of mines in the Georgetown district and is waiting for the coming of the railroad, to begin operations with the 30-stamp mill on the property. There is some low-grade ore blocked out in the mine, and Mr. Ireland expects to treat from 50 to 75 tons per day. On the Butterfly claim, a 2-ft. manganese vein with 7 in. of talc, giving good assays on both foot and hanging walls, has been opened. Some of the other mines in the district that have been partially developed, and upon which work will begin with the coming of the railroad, are the Red Line, Bonanza, Red Fir, Venus, Iron Mask, Red Rose and Iron Chancellor.

Flemming—L. S. Ropes and J. P. Latsch, of Helena, have recently taken over this and the Willard group in the Warm Springs district. The property has been undergoing development for the last 48 years and considerable underground work has been done. In the oxidized portions of the lode the ore is unusually rich and in the sulphide zone contains 1½ oz. gold and from 10 to 20 oz. silver, with some copper and lead.

Lewis and Clark County

Marysville Gold Mining Co.—This property is situated on the east side of Belmont Mountain. A portion of the group is known as the Annie Dillon property. The ground includes 100 acres, under development for four years. The Excelsior and Aztec claims have received special attention and the former has a 900-ft. tunnel which has opened an ore-

shoot 250 ft. long and 2 ft. wide. On the Aztec claim, sinking, crosscutting and drifting have opened the vein at 75 ft. depth. It is intended to install a 10-stamp mill soon, also an air compressor. Electric power will probably be obtained from the Missouri Power Co.'s plant at Lake Hauser. James Deering, Helena, is vice-president.

St. Louis Mining Co.—This company is working the Drumlummon mine and is operating a 20-ton stamp mill at full capacity; it is reported that this will be increased to 40 tons.

Bald Mountain—Colonel Cruse, of Helena, is operating this and the Belmont mines, keeping 20 stamps busy.

Bald Butte—This company is operating on a small scale and expects to start its stamp mill this summer.

Lincoln County

Fisher Creek Mining & Smelting Co.—The company is negotiating with Eastern men for the sale of the Brick & Brannigan mine in the West Fisher district. The property consists of three placer and six quartz claims on Bramlett Creek, 35 miles south of Libby, and is said to have produced $85,000 in gold and silver. Some ore is in sight, averaging about $6 per ton, according to an inspection just made by a Butte engineer. The property is equipped with a 10-stamp mill.

Snowshoe—Concentrates are being hauled from the mine, 20 miles south of Libby, for shipment to the smeltery. The ore is being hauled from the mine to the Libby Lumber Co.'s logging railroad, a distance of eight miles, by teams. William Jennison is operating the property, as receiver.

Libby Placer—Continuous operations are in progress at the company's hydraulic plant on Libby Creek. P. J. Brophy, president, is superintending work.

Madison County

Under the direction of W. B. McCubbin, of San Francisco, a California company has completed the relocation of 22 placer claims, extending from Granite Creek to the lakes, over ground believed to be the original channel of the famous Alder Gulch stream. The company has also taken an option on 1000 acres adjoining the claims. Development will be done, consisting of drilling with three Keystone drills. If pay gravel is discovered, a method of working used for some time in California will be tried. This will consist in running long tunnels into the hill east of Virginia City from the lowest level of Alder Gulch, and continued on a steep upgrade. A heavy stream of water will be piped from a reservoir on top of the hill and carried to the working breast to be used in sluicing the gravel. The gold will be retained in riffles in a flume carried along the floor of the tunnel.

Powell County

Yellow Pine—A good vein of free-milling ore has been opened in this mine in the Elliston district, and Manager Frank Powers has recommended to the owners that a three-stamp mill and a cyanide plant be erected. A shaft has been sunk 150 ft. and while crosscutting on this level, the vein was opened, the ore carrying gold and silver.

Nevada

Churchill County

Outlander—The company has recently bonded its nitrate lands in the northern part of the county, to W. C. Whitley and others, of San Francisco. It is reported that the lease calls for the payment of $1 per ton royalty, and $100,000 for the property.

Muttleberry—About one car per day is being shipped from these deposits to the Mason Valley smeltery.

Nevada Hills—Reports state that the company has made a contract with the International Smelting & Refining Co., for treatment of concentrates, and that the first shipment of two cars has been made.

Clark County

Yellow Pine—The production during June consisted of 1500 tons of zinc concentrate, 300 tons of lead concentrate and 200 tons of crude zinc carbonate, averaging 40% zinc. The mill ran continuously. Plans are under way to add additional jigs and concentrating tables. Another pumping plant is to be installed at Goodsprings to operate in conjunction with the present plant, and a larger generator will be installed in the mill to furnish electrical power for the new plant, and for the pumps now driven by gasoline engines.

Tam O'Shanter—It is reported at Goodsprings that J. E. Newberry, of Los Angeles, will erect a concentrating plant to treat the mixed lead and zinc ores from this and the Calico groups. The mill, which will be modeled after the Yellow Pine, will be erected either at Sandy or Mesquite, and will have sufficient capacity to handle custom ores. This should cause activity on the western side of the range. It is also understood that the company is negotiating with the Santa Fé R.R. to extend its spur from Ivanpah through Stateline Pass and into this portion of the district.

Kirby—F. C. O'Kelly, manager for the Campbell estate, has let contracts for considerable development work on the Kirby group. The mine is to be equipped with a new hoisting plant and ore shipments are expected to begin in the autumn.

Esmeralda County

Vernal—A raise has been started on a 4-ft. vein of quartz, known as vein No. 2. The crosscut on the 200-ft. level is over 60 ft. long.

Lucky Boy-Alamo—Frequent shipments are being made and the 10-stamp mill is in continual operation. Ore is being extracted principally from the 900-ft. level. Two new pumps are being installed at the station on this level.

Goldfield Consolidated—The estimated June production was 32,360 tons. Gross value recovered was $542,000; operating expenses, $200,000 and $342,000 net realization for the month.

Humboldt County

Antelope & Superior—John W. Geiger is reported to have stated recently that the company will soon let a contract for driving 500 ft. further in tunnel No. 4, to tap the oreshoots that were developed by three upper tunnels at 400 ft. depth. Two new Wilfley tables are being installed.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended June 27, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,500	86,419
Tonopah Belmont	1,900	52,626
Montana-Tonopah	1,109	26,592
Tonopah Extension	1,076	25,257
West End	805	18,459
Midway	.....	180
MacNamara	471	9,603
North Star	.....	80
Totals	8,861	219,216
Estimated value	$221,525	.....

According to dispatches a disastrous fire swept the business district of Tonopah on July 8, resulting in losses estimated at about $250,000.

MacNamara—On the 375-ft. level an oreshoot has been opened assaying over $100 per ton. Some good ore is also being developed on the 800-ft. level.

West End—A new oreshoot has been opened on the east drift on the 500-ft. level, carrying some $12 ore. The face shows 5 ft. of $38 ore.

White Pine County

Nevada Consolidated—On July 7, an explosion of dynamite, in boxes, killed 10 and injured two men, engaged in loading a hole in the Eureka pit.

New Jersey

The Green Pond iron mines at Green Pond, near Rockaway, in Morris County, are reported to have been sold by the Central Iron & Steel Co. to J. G. Jones, who represents a California syndicate. The ore is magnetite, but high in sulphur and phosphorus. The purchasing syndicate claims to have a new process for concentrating the ore and eliminating the impurities. The mines have rail connection with the New York, Susquehanna & Western and the Central R.R. of New Jersey.

Mount Hope—At this iron mine, in Morris County, the Empire Steel & Iron Co. is preparing to put in additional equipment and to sink a new shaft.

New Mexico

Miser's Chest—This group, sometimes known as the Lena group, is situated five miles south of Lordsburg, and is owned by James G. Berryhill, Des Moines, Iowa. Several veins with prominent outcrops traverse the property, which consists of six 600x1500-ft. claims. The property is undergoing development by Capt. S. W. Maltbie, of Lordsburg, who has a bond and lease. Equipment consists of a gasoline hoist, a small Leyner compressor, steam engine, boilers and necessary miners' tools.

New York

St. Lawrence County

One zinc mine in this county has made small shipments recently and several small zinc and lead deposits are being explored. A lead furnace was once operated in the county. The deposits are in veins, with calcite, in the limestone.

Oregon

Independent—This copper mine near Riddles is under option to a New York company. It has been extensively developed.

Old Glory—C. L. Mangun, president, has received returns of $143 per ton on ore recently shipped to the Tacoma smeltery from this mine, 45 miles northwest of Grant's Pass.

Utah

Beaver County

Cedar-Talisman — Drifting is being done on the 500-ft. level.

Noonday—The shaft has been completed almost as far as the 200-ft. level, and timbering is being done as the work of sinking progresses. There are stringers of iron ore in the bottom of the shaft.

Lady Bryan—Drifting is being done on the 500-ft. level, and 5 ft. of ore are reported to have been opened.

Leonora—Drifting is being done to get under old workings, productive in the past.

Juab County

Tintic shipments for the week ended June 21 amounted to 189 cars; those for the week ended June 28, to 181 cars.

Crown Point—The annual report shows a cash balance of $1243. A large amount of development work was done and this is being continued.

May Day—Pending the completion of negotiations in regard to railroad rates on zinc ore, no shipments of this class of ore are being made, and attention is being given to the installation of a new electric hoist.

Yankee Consolidated—Two cars of zinc ore, carrying from 39½ to 47½% zinc, are ready to be shipped.

Salt Lake County

Utah Copper—During May, 10,068,336 lb. of copper were produced.

Alta Consolidated—This company is stated to have marketed about $6000 worth of ore since the opening of the roads this spring. Most of the ore has come from the fissure in the tunnel, which has been followed 300 ft. Recently the No. 1 raise reached the contact, and 6 ft. of shipping ore have been opened; new ore has also been found about 100 ft. to the west of this point, 145 ft. above the tunnel level.

Summit County

Park City shipments for the week ended June 29, amounted to 3,312,000 lb. The Daly-West, Silver King Coalition and Daly-Judge were the principal shippers.

Ontario—The Mines Operating Co., which has taken a 10-year lease covering the property down to the 900-ft. level, is remodeling the old Ontario mill, putting the property in shape generally for operation. New equipment has been ordered. The initial capacity of the mill will be 150 tons per day, and provision will be made to double this later. Old stope fillings and ore of too low a grade to raise to the surface in the early days will be treated. George H. Dern, general manager of the Consolidated Mercur Gold Mines Co., is largely interested, and is in charge of the remodeling.

Daly—The report that this company would resume operations during July has been denied by the management.

New York Bonanza—Ore is being mined on the 200-ft. level, and the second car for June is being loaded. The ore is expected to bring about $15 per ton.

Tooele County

Galena King—Work is being done in ore on several levels. A car recently marketed is stated to have brought between $800 and $900. Regular shipments are being made.

Ophir Hill—The mill is being enlarged, and will have a capacity of 300 tons per day. A quantity of concentrates is awaiting shipment over the new branch line to St. John on the Salt Lake Route. The road will be in operation soon; the rails are laid and the resurfacing of the track is being completed.

Utah County

Shipments are again in progress from American Fork Cañon, after the winter's closedown. Leasers at the Wild Dutchman have a car of 50 tons at the railroad. The Pacific property has been developing for the last two months and mining ore for shipment. Leasers from Tintic have taken a lease on the Pacific dumps of second-class silver-lead ore, and are making concentrates by jigging. The Pacific is developing a large tonnage of milling ore, and it is thought will eventually install a mill. The Mineral Flat property, adjoining the Pacific, is not being worked, but it is reported that operations are to be resumed.

Canada

British Columbia

New Canadian Metal Co.—The installation of hoisting machinery and the enlargement of the concentrator are nearing completion. Mining and milling will soon be resumed at the Bluebell mine, on Kootenay Lake. S. S. Fowler is general manager.

British Columbia Copper Co.—Work has been resumed at the company's Lone Star mine, near Greenwood, and at the Napoleon mine in Washington. Some good ore was found on No. 14 claim, of the Voigt group, and a compressor and six diamond drills have been taken in so that extensive prospecting may be done before a payment on the property becomes due in November.

Ontario

Dane Mining Co., Ltd.—This company owns six claims in Lebel and Teck townships, three miles north of Dane station, on the Temiskaming & Northern Ontario Ry., 60 miles north of Cobalt, and southwest of the Porcupine district. Montreal men are interested. Results of development to date are stated to be satisfactory; two lenses of chalcopyrite ore, averaging 16% copper, and from 0.02 to 0.03 oz. gold, with a width of about 3 ft., have been uncovered in one shaft, about 60 ft. below surface. Another shaft is 110 ft. deep on a 10-ft. vein of quartz carrying chalcopyrite and bornite averaging 2% copper with a little gold. A small plant has been installed and development work in the two shafts is being pushed under the management of Alexander D. McPhee. G. O. McMurtry is mining engineer.

Ontario—Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended July 5, and for the year to date, are:

La Rose	75.53	1,823.17
Coniagas	110.42	1,110.68
O'Brien	.....	294.49
Right of Way	.....	148.60
Chambers-Ferland	.....	225.60
McKinley-Darragh	108.88	1,367.95
Nipissing	94.41	1,079.99
Hudson Bay	31.48	375.70
Buffalo	29.03	642.42
Crown Reserve	.....	259.29
Cobalt Townsite	32.07	768.63
City of Cobalt	.....	145.84
Tretheway	42.05	283.09
Colonial	.....	41.60
Kerr Lake	61.05	411.08
Cobalt Lake	.....	341.59
Drummond	.....	339.30
Temiskaming	.....	586.92
Beaver	.....	187.89
Wettlaufer	.....	111.21
Provincial	.....	22.22
Casey Cobalt	.....	68.35
Lost and Found	.....	15.00
Totals	586.27	10,650.61

Bullion shipments in ounces

Nipissing	123,891.18	1,910,909.49

Nova Scotia—This property has been taken over by the Dominion Reduction Co., of which D. M. Steindler is presi-

dent and Eugene Steindler secretary. Alterations have been made in the mill to secure increased concentration in the treatment of conglomerate ores. Nothing will be done with the mine at present.

ONTARIO—PORCUPINE

McIntyre—An unusually righ oreshoot has been uncovered in the opencut near No. 1 shaft. The mill has returned $6000 during the last six days.

Porcupine Lake—This company will install a plant and will develop the ground under the lake.

Hollinger—On July 4, the first cleanup of bullion took place in the presence of a number of officials and shareholders. No official statement was made but the results are stated to have been satisfactory. Thirty stamps are dropping regularly. The winze near the main shaft is down 75 ft. below the 200-ft. level and is still in ore. The raise from the 200- o the 100-ft. level is completed and is all in ore. An oreshoot of 600 ft. has been opened on the second level, and it is stated that for 100 ft. it averages over $200 per ton. The Dixon vein has been cut at the 100-ft. level.

Porcupine Gold—The mill is crushing from 75 to 85 tons of ore per day. The ore is being taken from the 100-ft. level in the Godfrey vein. At the 300-ft. level it is found that the Godfrey and the Davidson veins apparently join. There are now over 6000 tons of medium-grade ore on the dump. Stoping from the 200- to the 100-ft. level is in progress.

Plenaurum—A quartz vein 3 ft. wide, running at right angles to the main vein, has been cut at the 200-ft. level.

ONTARIO-SUDBURY

Canadian Copper Co.—An inclined compartment shaft is being sunk in the foot wall of the Froud orebody. It will be continued to about 1000-ft. vertical depth and a similar shaft will be sunk on the same orebody 1000 ft. east. The intention is to connect the two shafts underground and to install an extensive underground mining system with electric haulage and other facilities to handle a large output. Drilling has been under way for about two years and shows a large orebody. This mine will be known as No. 3 and will be connected with the Copper Cliff smeltery by a railroad extension. The company is also drilling the Cryderman property in Falconbridge township, and the Rothschild tract, on Lake Wanahpatei. The capacity of the smeltery at Copper Cliff is being increased to between 3000 and 4000 tons per day. Five blast and five reverberatory furnaces are now in operation.

QUEBEC

McDonald Extension—Plans have been made for the exploration, by drilling, on land adjoining the McDonald copper mine at Weedon. Smith & Travers, of Sudbury, have the contract for drilling.

Mexico

DURANGO

Lustre—Extensive development is under way at this mine near Rosario, by the reorganization committee. The property is owned in Pittsburgh and a large investment in equipment was made several years ago, including a smeltery and a gas-producer power plant. Clawson & Gillingham, of Los Angeles, are in charge of the operations. W. L. Curry, of Pittsburgh, is the new president.

HIDALGO

New York men are examining properties adjoining the Santo Tomas in El Chico district, at Pachuca.

JALISCO

San Pedro Analco—This Mexican-owned mine, on the Santiago River in the Hostotipaquillo district, is under option to American men, supposedly associated with the United States Smelting, Refining & Mining Co. The mine was once a producer of silver. Hydro-electric power is obtained from a plant constructed on the Santiago River, about four years ago.

MEXICO

El Oro—A report recently issued states that, including the estimated profit for June, the total profit for the year ended June 30, 1912, will be approximately £180,000, which added to the amount carried forward from 1911, gives a total profit of £264,759. During the last six months development has proceeded in the northern orebody on the 286-, 486- and 550-ft. levels, and has opened considerable ore varying in grade from $6 to $7 per ton and from 5 to 20 ft. wide. Ore running from $5 to $8 per ton and from 35 to 60 ft. wide has been opened on the San Juan level of the southern orebody. Work has also opened ore of good grade on the 1000 and 1150 levels. On the 1300-ft. level the San Rafael vein, where opened, revealed low-grade ore. Some ore running from $5 to $10 per ton was disclosed on the zero level of No. 1 vein, from the San Patricio shaft. Crosscuts are being driven from an old shaft near the Chihuahua vein. The ventilating shaft was connected with the 1300-ft. level and the interior shaft was sunk to the 1000-ft. level, where drifting was commenced.

OAXACA

Santa Lucia—Operations at this copper mine in the northern part of the state, have been discontinued, owing to the exhaustion of high-grade ore. J. Samuel Coupal, of Boston, was in charge for the American company that had this option.

SONORA

West Coast Mining & Smelting Co.—This company, financed in Holland, has continued its development of the copper deposits about 50 miles west of Carbo, near the Gulf of California. Recently European engineers have visited the property and it is reported that plans for a smelting plant and a railroad to the Gulf are to be carried out. The district is a new one and has been under exploration for about two years.

Central America

COSTA RICA

Aguacate Mines—The amalgamating mill which was started last November was augmented on May 1, by the sand-treatment department of the cyanide mill. Steam power was turned off on June 1, and power is now being supplied by the hydro-electric plant. The ore breaker and sorting floors are being transferred from the mill to a position over the mine bins. Inclined chutes for handling ore in the stopes have been replaced by vertical ones, resulting in a reduction of the cost of handling ore to the mill. New orebodies have been opened recently on the fourth and fifth levels. The west vein, which was cut off by a fault to the south, has been traced beyond the fault and the ore is being blocked out in a new section. The seventh level, being driven 220 ft. below the fifth, is expected to cut the vein about Jan. 1, 1913. This tunnel is large enough to permit electric haulage directly to the mill. P. G. Spilsbury, San Mateo, is in charge.

Montezuma—Construction and mine developments have been carried on during the dry season, as no power was available for milling. The rainy season has now set in and the power plant is in operation. The mill and cyanide plant will be kept running during the rainy season. H. B. Price, San Mateo, is manager.

La Compañia Minera Del Porvenir—A complete 10-stamp mill and cyanide plant have been purchased. Power will be furnished by steam engines using wood fuel, until electrical power is brought into the district. The mill will not be erected until the end of the wet season, in December, as hauling is difficult. Development has been under way for over a year. James Dagan is president.

South America

CHILE

Braden—On July 7, 30 men were killed by an explosion underground. The accident is supposed to have occurred near a winter storehouse and remote from actual mining operations, but it may have been in development workings.

Asia

CHOSEN

Oriental—Cable dispatches state that the June cleanup totaled $140,000.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, July 10—There is very little new to record in the coal trade in the West. Business at all the large consuming centers continues steady, but supplies are abundant and prices generally remain about the same. The Lake trade is improving as supplies at the Lake ports are more abundant. The supply of vessels, however, still exceeds the requirements. The Lake anthracite trade is behind, as there were practically no shipments made in May.

In the East, the bituminous trade is still dull and prices are low, but the coastwise trade is looking up a little. Anthracite trade is steady, dealers and consumers being more inclined to put in stocks. The demand for steam coal is very fair.

Anthracite shipments in June were 6,199,428 long tons, a decrease of 15,929 tons from June, 1911. For the six months ended June 30, the total shipments were 35,309,583 tons in 1911, and 26,104,761 in 1912; decrease this year, 9,204,822 tons.

British Coal Trade—Exports of fuel from Great Britain, with coal furnished to steamships in foreign trade, five months ended May 31, in long tons:

	1911	1912	Changes
Coal	26,255,066	20,416,679	D. 5,838,387
Coke	392,889	336,969	D. 55,920
Briquettes	717,655	526,634	D. 191,021
Total exports	27,365,610	21,280,282	D. 6,085,328
Steamer coal	7,884,191	6,564,682	D. 1,319,509
Total	35,249,801	27,844,964	D. 7,404,837

Imports of coal for the five months were 7652 tons in 1911 and 162,207 tons this year.

German Coal Production—Coal production of German Empire, four months ended Apr. 30, metric tons:

	1911	1912	Changes
Coal	52,462,032	56,083,434	I. 3,621,402
Brown coal	24,136,045	26,769,972	I. 2,633,927
Total mined	76,598,077	82,853,406	I. 6,255,329
Coke made	8,426,499	9,061,380	I. 634,881
Briquets made	6,949,956	7,856,712	I. 906,756

Of the briquettes reported this year 6,226,447 tons were made from brown coal or lignite.

Iron Trade Review

New York, July 10—The only change in the iron and steel trade which is to be noted this week is some falling off in the quantity of new orders, but this was generally expected. The flood of specifications which came in just before July 1, is keeping the mills very busy and the usual midsummer stops for repairs are being cut as short as possible.

The principal new business reported this week is in orders for cars which have been placed freely by several roads. There have also been a number of small orders for rails placed, including quite a proportion of trolley rails. Structural business has been mainly in small orders, but makes up a very comfortable total. Other lines have been quiet.

In pig iron buying continues rather freely for foundry in Seaboard territory while in the Central West basic is being taken quite freely. Some lots of bessemer pig are being taken by the steel companies from merchant furnaces. Prices are pretty firm generally, though without any quotable advance for early deliveries. Furnaces, however, are inclined to ask a little more for fourth-quarter iron and this is generally conceded by buyers. In the South accumulated stocks have been pretty well worked down and most furnace yards are now bare of everything beyond the small amounts usually carried.

Pig Iron Production—The reports from the blast furnaces as collected and published by the *Iron Age*, show that on July 1, there were 248 coke and anthracite stacks in blast, having an aggregate daily capacity of 81,700 tons of pig iron, an increase of 200 tons over June 1. Making allowance for the charcoal furnaces, the estimated make of pig iron in the United States in June was 2,465,250 tons; for the six months ended June 30, it was 14,028,050 tons. Of this total, 10,439,200 tons, or 74.4%, was made by the furnaces owned and operated by the steel companies.

Baltimore

July 8—Exports for the week included 339,045 lb. steel billets, 228,600 lb. trolley rails and 11,300 lb. rail splices to Glasgow; 4,047,810 lb. steel billets; 224,300 lb. lead to Antwerp. Imports included 1185 tons ferromanganese from Liverpool; 5850 tons iron ore from Cuba.

Birmingham

July 8—The pig-iron market in Southern territory is strong again, the general quotation for third quarter delivery being around $11.50 per ton, No. 2 foundry basis, while $12 is expected to be the minimum price for last quarter. A few small orders have already been booked at the latter figure and inquiries are in hand. The Alabama Consolidated Coal & Iron Co. receivers are operating only one furnace besides coal and ore mines, coke ovens, and other properties. The Woodward Iron Co. has blown in one furnace and has put out another to be rebuilt. This company is making a third furnace ready. The Tennessee Coal, Iron & R.R. Co. has made an appropriation to make improvements at its sixth furnace at Ensley and it will be placed in commission as soon as ready, in about four months. The Sloss-Sheffield Steel & Iron Co. has two blast furnaces almost ready. The Sloss-Sheffield Co. is the only one that has any accumulated iron on hand, but this is being removed steadily.

Foundries and machine shops are doing fairly well with prospects of a continuation through the summer. There is a good feeling among the scrap-iron dealers. Charcoal iron makers hold their product at $22@22.50 per ton, with the make about equal to the demand.

Chicago

July 9—The iron market shows decided strength as regards both pig iron and finished materials; the demand for pig iron continues light while that for iron and steel products of almost every sort is heavy, despite some advanced prices.

Such sales of pig iron as are being made are for small lots with delivery in the last quarter or last half—more being for delivery soon than later—at unchanged prices, Southern No. 2 bringing $11.50 Birmingham, or $15.85 Chicago and Northern No. 2 $14.50 at furnace, on nearly all the business done. Lake Superior charcoal sells for $15.50@16. The melters are not likely soon to begin buying heavily for this is their slack season.

Structural material continues in large demand for local and western new construction with material under 15 in. holding to 1.48c. Railroad supplies find a large sale with little business solicited, the problem being to take care of that which flows in. Bars are in good demand with the mills still crowded and soft-steel bars holding up firmly to 1.43c.; bar iron remains at 1.25c. For plates, sheets and wire products the demand is large everywhere, plates especially being strong at 1.43c. General business conditions support the belief that there will be no check soon to the heavy buying.

Cleveland

July 8—Iron-ore shipments for June have been very heavy, exceeding 7,500,000 tons.

Pig Iron—Sales have been fair only, but the market is strong and the tendency of prices upward. Two furnaces in this district have been obliged to blow out for repairs. Prices, Cleveland delivery, are $15.15 for bessemer, $13.75 for No. 2 foundry, $13.25 for gray forge and $17.50@18 for Jackson County silvery.

Finished Material—Specifications on contracts have been very heavy and the mills are well filled with work. New orders have been rather slow. The markets are strong at the recent advances.

Philadelphia

July 10—The disturbed coke situation is indirectly having an unfavorable effect on pig iron. Coke concessions are not in sight. Furnace interests argue with some plausibility that pig iron will rule higher before long, but to offset this possibility most large consumers are pretty well supplied for the time being. Inquiries have fallen off since July 1 and sales have been of moderate proportions. Makers are willing to allow a month or two to pass, to see how things figure out, before formulating any policy. The well oversold condition is their strongest point. Quotations are $15.50 for No. 2X, $15 for gray forge, with basic at $15.50 as an asking price, which could be shaded in favor for a large buyer.

Steel Billets—Billets are quiet under very little inquiry, due to unusual activity in weeks past.

Bars—Bars are doing well and much new business has been booked for car work, as a result of negotiations opened early in June.

Sheets—The sheet market is quiet and mills are pretty well oversold. Supplies for immediate delivery are being called for and this business commands a premium.

Pipes and Tubes—Cast pipe is very strong, though scarcely any new business has been placed. Merchant pipe is dull after some weeks of activity. Tubes are active and consumption is heavy.

Plates—The mills are rushing material with the greatest speed to make room for new business that is pending. All kinds of capacity is taxed.

Structural Material—A good week's business has been done, which consisted mainly of a closing of orders which have been on the market.

Scrap—A great deal of scrap is arriving for yard storage, mainly of low-grade material from country localities. Large lots, consisting of old rails and railroad scrap, are located at producing points and will be sold from those points.

Pittsburgh

July 9—Production of steel has been greatly curtailed by the hot weather. This being the first really hot spell the effect is most pronounced. Later hot weather will find the men more or less inured. Production was curtailed last week also by the national holiday, falling close to the middle of the week. Many mills, particularly sheet and tinplate mills, did not resume Friday, and thus lost a total of nearly three days' time, spent more or less profitably in making repairs. There are a few mills definitely off for repairs this week. Altogether, steel production this month is going to fall decidedly behind that of June. New business is lighter, on account of the season, and specifications have, on the whole, fallen off; as to many important cases, contracts expired June 30, and were succeeded by higher priced contracts on which specifications are naturally lighter.

The mill position is a strong one, there being a very large volume of actual business on books, probably the largest volume of really sound business on record.

Prices of finished steel products, as far as any trend is shown in this dull season, are hardening. In sheets and tinplates the hardening is decided. The tinplate market is quotable now at a minimum of $3.50. This is the level to which the American Sheet & Tin Plate Co. recently advanced its price, selling by independents at $3.40 continuing until recetnly, in the case of attractive business. Some of the mills have tinplate specifications sufficient to run them well into September.

Pig Iron—The pig-iron market is in a very unsatisfactory position from the sellers' standpoint. There is no life to the inquiry, and it is impossible to obtain a measure of the advance which should occur if the advances in steel products averaging more than $3 a ton, furnish any criterion. Even the strenuous effort of the Connellsville coke operators to obtain $2.50 for second-half coke has not served to stiffen pig iron. That movement has made no material progress in the past week, the deadlock continuing. There are suspicions that a few of the operators have sold prompt coke at under $2.50, although that is the prevailing quotation, and it is also rumored from the East that some furnaces have banked, in an effort to avoid complying with the terms of the operators. Sales of pig iron in the past week have been very light. Prices have been maintained, but have not advanced, despite the fact that a number of furnaces have raised their asking prices. We continue to quote: Bessemer, $14.25; basic, $13.25; No. 2 foundry, $13.25; malleable, $13@13.25; forge, $13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—Business in ferromanganese is light, but occasional inquiry is developing for second-half deliveries, as well as for deliveries over the first half of next year. A contract for 100 tons a month over the present half-year has been closed with a steel casting plant outside this district. Prompt ferromanganese is $50@52, Baltimore, while the regular contract price prevails for forward delivery, $48.50, Baltimore.

Steel—Billets and sheet bars are very scarce for any delivery in July or August, but there is considerable inquiry for odd lots, which goes to brokers, who can frequently furnish material by making deals of one sort or another. The steel mills cannot make any early deliveries, and for late deliveries are disposed to hold off. Prices quoted are partly nominal: Billets, $21.50; sheet bars, $22, f.o.b. maker's mill, Pittsburgh; billets, $21@21.50; sheet bars, $22, f.o.b. maker's mill, Youngstown. Rods continue to be quoted at $25, Pittsburgh, but an attractive inquiry would probably bring out a price of $24.50 per ton.

Sheets—Late on July 3 the American Sheet & Tin Plate Co. advanced its price on blue annealed from 1.40c. to 1.45c., for No. 10 gage, being sold up for seven weeks or longer, with the independents also well sold up. The new price immediately became the general market. Black sheets have continued to stiffen, and 1.95c. is the absolute minimum of the market, with little tonnage available at that figure. Automobile manufacturers and others requiring a regular supply are placing contracts for second half or the late months of the year, usually at a premium of $1 a ton above 1.95c., on account of the extended delivery and because they wish to be assured of a regular supply. Specifications have been coming in at an excellent rate and the mills are filled up farther ahead than at any time for a year or two. We quote: Blue annealed, 10 gage, 1.45c.; black, 28 gage, 1.95@2c.; galvanized, 28 gage, 3c.; painted corrugated, 28 gage, 2.15c. per lb.; galvanized, 3.05c. per pound.

St. Louis

July 8—The iron market has not been active the past week. Besides the holiday a number of the larger foundries and steel plants have shut down to make repairs, and present needs for iron are light. Most foundrymen have enough iron on hand to last for two or three months and are not inclined to make any large purchases until the summer season is over. Southern No. 2 foundry is quoted at $11@11.25, Birmingham, or $14.75@15, St. Louis. Northern No. 2 foundry is quoted $14.50@15 at furnace.

The coke market has had quite an advance and good foundry coke is quoted $5.65, St. Louis.

Iron Ore Trade

Iron-ore movement from Lake Superior is heavy. On the Great Northern ship-

ments from mines have beeen delayed by capacity of equipment, and ore boats have been held up at the Allouez docks in consequence. The shipments from Steel Corporation mines on the Hill leases have been very heavy.

Imports of iron ore into Great Britain, five months ended May 31, were 3,021,361 tons in 1911, and 2,313,281 in 1912; decrease 708,080 tons. Imports of manganese ore were 156,850 tons in 1911, and 118,676 in 1912; decrease, 38,174 tons.

Foreign Iron Trade

German Foreign Trade—Exports and imports of iron and steel, and of machinery, in the German Empire, five months ended May 31, metric tons:

	Exports	Imports	Excess
Iron and steel..	2,413,073	268,784	Exp. 2,144,289
Machinery.....	204,329	36,025	Exp. 168,304
Total.....	2,617,402	304,809	Exp. 2,312,593
Total, 1911.....	2,240,464	271,875	Exp. 1,968,589

Increase in exports this year, 376,938 tons; increase in imports, 32,934 tons.

Metal Markets

New York, July 10—The metal markets have been a little unsteady, and copper has reached a lower level.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January....	110	111	July.....	112	.....
February..	115	109	August.....	117	.....
March.....	112	111	September.	111	.....
April.....	114	115	October....	112	.....
May.....	118	118	November.	111	.....
June.....	115	117	December..	110	.....

Year 1909, 115; 1910, 115; 1911, 112.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
May 1912..	$ 4,450,899	$ 3,346,491	Exp. $1,404,408
" 1911..	6,817,149	5,014,741	Exp. 1,802,409
Year 1912..	26,225,801	19,653,285	Exp. 6,572,516
" 1911..	10,176,807	29,005,312	Imp. 18,828,505
Silver			
May 1912..	6,725,781	4,345,032	Exp. 2,380,749
" 1911..	5,054,304	3,555,842	Exp. 1,498,462
Year 1912..	28,623,028	20,384,764	Exp. 8,238,264
" 1911..	28,665,500	18,454,155	Exp. 10,211,345

Exports from the port of New York, week ended July 6: Gold, $2,191,869, chiefly to Paris; silver, $1,315,434, principally to London. Imports: Gold, $365,988, nearly all from Mexico; silver, $77,559, mainly from South America.

Gold—The price of gold on the open market in London remained at the bank level, 77s. 6d. per oz. for bars and 76s. 4d. per oz. for American coin. Some gold was taken for Germany. In New York $4,000,000 more was taken for shipment to Paris.

In addition to the gold recently reported shipped from London to India in the five months, ending with May, further sums of £4,845,000 from Australia and £3,700,000 from Egypt were shipped to India, making the total amount of gold sent to that country in the five months, £13,150,000. Since June 1, more shipments have been made from Australia.

Iridium—The current price of this metal is $63 per oz., New York.

Platinum—The market is quiet and prices are still unchanged, dealers asking $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes under date of June 25, that there is practically no business at St. Petersburg. Speculators have bought small lots at Ekaterinburg from the starateli at a little lower price. They will not, however, reduce their quotation for large lots and no considerable quantity of the metal can be bought below the quoted figures. Nominal quotations are 9.80 rubles per zolotnik at Ekaterinburg and 37,500 rubles per pood at St. Petersburg for crude metal, 83% platinum. These prices are equal to $36.85 and $36.75 per oz., respectively.

Silver—The market has weakened on official reports of unfavorable monsoon conditions, and on selling by Chinese Banks, dropping to 27 15/16d. in London, but closes steadier at 28 1/16d. on Indian Bazaar buying. It is too early yet to form any opinion of crop conditions in India.

Silver in New York, July 3, was 61 1/8c.; in London, 28 1/8d.

SILVER AND STERLING EXCHANGE

July	4	5	6	8	9	10
New York....	....	61 1/8	61	60 3/4	60 7/8	61
London....	28 1/16	28 1/8	28 1/16	27 15/16	28	28 1/16
Sterling Ex..	....	4.8730	4.8730	4.8725	4.8730	4.8735

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

Copper—The market during the week of July 4-10 has been unsettled by the demoralization in the London standard market. Copper in Europe has declined very much below our parity, transactions in electrolytic having been reported at as low as 16½c., and under these circumstances American producers could not, of course, sell in Europe without meeting the European price, which they have not been inclined to do. On this side consumers have naturally refrained from buying pending a settlement of the present disturbed conditions. Some of the agencies, which have well filled their books at higher prices, are quite indisposed to recede therefrom, and having no object in offering copper maintained their previous price of 17¾c., delivered, usual terms, as their price nominally asked, meaning simply that they do not want to sell any copper at the market.

NEW YORK

July	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
3	17¾ @17⅞	17.20 @17.25	45¼	4.75	4.65 @4.67½	6.90 @7.00	6.75 @6.85
5	17¾ @17⅞	17.15 @17.25	45⅜	4.75	4.62½ @4.65	7.05 @7.15	6.90 @7.00
6	17¾ @17⅞	17.15 @17.25	45¼	4.75	4.62½ @4.65	7.10 @7.20	6.95 @7.05
8	17¼ @17½	17.05 @17.15	45	4.75	4.62½ @4.65	7.10 @7.20	6.95 @7.05
9	17¼ @17¾	17.00 @17.05	44	4.75	4.62½ @4.65	7.10 @7.20	6.95 @7.05
10	17¼ @17¾	17.00 @17.05	44⅜	4.75	4.62½ @4.65	7.10 @7.20	6.95 @7.05

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

July	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
3	76 11/16	77 13/16	82¼	205	201	18 3/16	26¼
4	77	77 13/16	82¼	205	200¾	18⅛	26¼
5	76 11/16	77⅛	82⅛	206	201	18⅛	26¼
8	75 13/16	76 11/16	81¼	204	198¾	18⅛	26¼
9	74¼	75	79¾	201	196	18⅛	26
10	74¼	75⅛	80	202¼	197	18⅜	26

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; ± £25 = 5.44c.; £70 = 15.22c. Variations, £1 = ± 21¾c.

Other agencies, who are disposed to sell, invite inquiries and bids but hesitate about making offers under present circumstances inasmuch as there is but little chance of placing round lots. Under these circumstances the market is chiefly made by speculative resales and the transactions of *arbitrageurs*, to the latter of whom the great disparity between London and New York offers opportunities. Some relatively small sales of electrolytic have been made by first hands down to the basis of 17c., cash, New York, during the latter part of the week, and even less. Some round lots of Lake copper have been sold by producers to American consumers who needed to re-

plenish their supplies, in which respect the Lake market has differed from the electrolytic. The close is unsettled at 17⅛@17⅜c. for Lake copper, and 17@17.05c. for electrolytic copper in cakes, wirebars and ingots. Casting is quoted nominally at 16⅞@17c. as the average for the week.

The London standard market, after having declined for some weeks, continued the downward pace at an accelerated rate, the movement culminating in a sharp break, which took place on Tuesday morning, when prices touched £71 12s. 6d. for spot, and £72 10s. for three months. Since then, there has been a sharp reaction, and the market closes sensitive at £74 5s. for spot, and £75 12s. 6d. for three months. The crash has taken out of the market a great many weak accounts, and the position at the end of the week, while still very nervous, indicates that the speculative markets are decidedly on the mend.

Copper sheets are 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 19@19¼c. base, carload lots at mill.

Copper exports from New York for the week were 6248 long tons. Our special correspondent reports the exports from Baltimore at 940 tons.

The *Echo des Mines* of June 20, reports a sale at Antwerp of 279 metric tons of pig copper from Katanga, which brought 192 fr. per 100 kg.—equal to 16.8c. per lb. A second lot of 30 tons was held for another sale.

Tin—The movement of the market during the week has been rather uncertain, showing the activity of speculation, of which the ultimate tendency has not yet developed. After declining all the week, the market shows a better tendency, at the close, which is cabled at £202 10s. for spot, and £197 for three months.

The quotations here show a diminution in the premium for near-by tin, the close being firmer at around 44⅜c., New York.

Messrs. Robertson & Bense report the arrivals of tin ore and concentrates at Hamburg, Germany, in June at 1317 tons, all from Bolivia.

Lead—The leading interest advanced its price on July 3 to 4.75c., New York. A fair-sized business has been done on that basis, while St. Louis is quoted at 4.62½@4.65 cents.

The London market for lead, after advancing to £18 12s. 6d., has had a slight reaction, the close being somewhat easier at £18 7s. 6d. for Spanish lead, and 2s. 6d. higher for English.

Spelter—The market for spelter has been very dull, the principal buyers not even having invited any offers. Several important smelters report no transactions at all. Some speculative interests who needed to make good their contracts appeared in the market and bid up the price on relatively small business. Some tonnage of August spelter is reported sold to consumers at 7c., St. Louis. Any belated consumer needing July spelter will undoubtedly have to pay a handsome premium, which has in fact been realized on some carload business, the supply for this delivery being very short. On the other hand there are no buyers for even September spelter. Under these circumstances the market is in an awkward position for all parties. The close is firm at 6.95@7.05c. St. Louis, and 7.10@7.20c. New York.

The London market is unchanged, good ordinaries being quoted at £26, and specials at £26 5s. per ton.

Base price of zinc sheets was advanced 10 points on July 6, and is now $8.75 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7¼@7⅜c. per lb. in carload lots, New York.

Other Metals

Aluminum—Business continues good for the season and consumption still appears to be large. The quotation is firm at 22½@23c. for No. 1 ingots, New York. The foreign market is steady.

Antimony—Business during the past week has been very good and large sales have been made. Prices are again firmer. Cookson's brings 8.25@8.50c. per lb. and Hallett's 7.87½@8c. For Chinese, Hungarian and other outside brands, 7.25@7.50c. per lb. is paid.

Quicksilver—Business has been rather quiet and there is no change reported in prices. New York quotations are $42.50 per flask of 75 lb., with 60@62c. per lb. asked for retail lots. San Francisco, $42 for domestic orders and $39.50 for export. The London price is £8 10s. per flask, with £8 7s. 6d. asked from second hands.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Imports and Exports of Metals

Exports and imports of metals in the United States, five months ended May 31, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	155,960	78,460	Exp. 77,500
Copper, 1911	137,439	65,760	Exp. 71,679
Tin, long tons	294	23,876	Imp. 23,582
Tin, 1911	504	18,469	Imp. 17,965
Lead short tons	32,019	40,329	Imp. 8,310
Lead, 1911	45,271	39,619	Exp. 5,652
Zinc, short tons	4,987	2,745	Exp. 2,242
Zinc, 1911	2,799	933	Exp. 1,866
Nickel, lb.	10,914,439	14,988,043	Imp. 4,073,604
Nickel, 1911	10,006,806	11,756,902	Imp. 1,750,096
Antimony, lb.	50,480	6,850,135	Imp. 6,799,675
Antimony, 1911	150,704	3,956,796	Imp. 3,806,092
Platinum, oz.	.....	40,870	Imp. 40,870
Platinum, 1911	47	41,863	Imp. 41,816
Aluminum, lb.	9,656	10,179,879	Imp. 10,170,223
Aluminum, 1911	.....	.....	.....
Ores, etc.			
Zinc in ore, lb.	12,117,607	13,282,996	Exp. 1,165,38
In ore, 1911	11,146,207	12,941,984	Imp. 1,795,77
Zinc oxide, lb.	15,653,983	.....	Exp. 15,653,98
Zinc oxide, '11	14,802,491	.....	Exp. 14,802,49
Zinc dross, lb.	384,696	.....	Exp. 384,69
Zinc dross, '11	4,033,416	.....	Exp. 4,033,41
Chrome ore, l.t.	.....	23,351	Imp. 23,35
Chrome ore, '11	5	16,479	Imp. 16,47

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 24,462 tons; exported, 10,702. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include re-exports of foreign materials.

Zinc and Lead Ore Markets

Platteville, Wis., July 6—The base price paid this week for 60% zinc ore was $55@56. The base price paid for 80% lead ore was $55@57 per ton.

SHIPMENTS, WEEK ENDED JULY 6

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	688,160	.....	.....
Shullsburg	605,280	.....	.....
Benton	541,700	.....	358,900
Platteville	419,050	.....	181,800
Hazel Green	320,000	.....	.....
Cuba City	82,770	.....	.....
Galena	82,000	.....	.....
Harker	60,900	.....	.....
Total	2,799,860	.....	540,700
Year to date	106,915,330	4,496,470	15,374,070

Shipped during week to separating plants, 1,904,250 lb. zinc ore.

Joplin, Mo., July 6—The high price of zinc sulphide ore this week was $61, the base per ton of 60% zinc $53@58. Zinc silicate sold at $29@31 per ton of 40% zinc. The average price all grades was $54.08. The high price of lead ore was $60.50 base per ton of 80% lead, and the average price all grades was $58.54 per ton.

The zinc ore market, while showing no change on the high-grade ores, was much stronger on the middle or second grades, much of that class selling for $56@57 per ton base. The production was cut about 1500 tons this week on account of the observance of the Fourth; many mines did not restart during the week.

SHIPMENTS, WEEK ENDED JULY 6

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,880,590	.....	1,055,780	$141,739
Joplin	1,818,150	.....	310,410	60,817
Galena	817,950	.....	48,900	24,222
Duenweg	702,590	.....	83,460	22,091
Alba-Neck	564,500	.....	.....	16,370
Jackson	483,440	.....	.....	13,535
Granby	1,660	577,390	21,520	10,265
Oronogo	492,070	.....	.....	11,170
Spurgeon	139,120	194,540	67,690	8,969
Miami	280,470	.....	.....	6,731
Quapaw	131,010	.....	.....	3,537
Cave Springs	106,010	.....	6,770	3,150
Aurora	65,260	57,020	.....	2,616
Springfield	69,000	.....	.....	2,000
Carl Junction	63,590	.....	.....	1,875
Lawton	61,360	.....	.....	1,718
Totals	9,676,770	828,950	1,594,530	$330,805
27 weeks	272,891,630	16,911,690	46,278,720	$8,414,053

Blende val., the week, $270,580; 27 weeks, $6,897,175
Calamine, the week, 13,547; 27 weeks, 251,834
Lead value, the week, 46,678; 27 weeks, 1,265,044

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54.18
May	38.25	55.30	36.79	53.27	55.21	52.45
June	40.50	55 88	38.18	54.38	56.49	55.01
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59 33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57 19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Cement

The Atlas Portland Cement Co., on July 8, announced an increase of 5c. per bbl. on portland cement, making the price 70c. per bbl. at mill. The demand for cement has recently been large and the sales heavy.

Chemicals

New York, July 10—The market generally is quiet and no activity is expected during July.

Arsenic—Supplies are better as arsenic is now coming in regularly from Canada and Mexico, besides a little from England. Apparently they do not exceed consumption and prices are unchanged at $3.75 per 100 lb. for spot and $3.62½ per 100 lb. for futures.

Copper Sulphate—The market is quiet and unchanged at $5.50 per 100 lb. for carload lots and $5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade in this article is rather quiet but prices are steady, 2.45c. per lb. being asked for both spot and futures.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, five months ended May 31.

	Imports	Exports	Excess
Copper sulph. lb.	.....	7,280,235	E. 7,280,235
Copper sul., '11	.....	7,166,034	E. 7,166,034
Bleach, lb.	29,238,111	400	I. 29,237.711
Bleach, 1911	39,537,249	17,368	I. 39,519,881
Potash salts, lb.	274,434,808	1,578,332	I. 272,855,976
Potash salts, '11	340,189,824	2,077,000	I. 338,112,824
Soda salts, lb.	4,873,954	200,712	I. 4,673,242
Soda salts, 1911	15,015,946	237,755	I. 14,778,191
Acetate lime, lb.	.....	29,927,147	E. 29,927,147
Acetate, 1911	.....	32,485,710	E. 31,485,710
Nit. of soda, tons	197,497	4,224	I. 193,273
Nitrate, 1911	273,096	3,233	I. 269,863
Phosphates, tons	.....	468,548	E. 468,584
Phosphates, '11	.....	498,257	E. 498,257
Sulphur, tons	7,414	18,513	E. 11,099
Sulphur, 1911	10,602	4,786	I. 5,816
Pyrites, tons	380,731	.....	I. 380,731
Pyrites, 1911	418,429	.....	I. 418,429
Magnesite, lb.	76,836,305	796,992	I. 76,039,313
Magnesite, 1911	115,941,052	1,123,125	I. 114,817,927
Sul. ammonia, lb.	50,096,146	134,715	I. 49,961,431
Sul. am'nia, '11	90,021,481	.....	I. 90,021,481
Arsenic, lb.	1,794,920	850	I. 1,794,070
Arsenic, 1911	2,119,879	.....	I. 2,119,879

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 159,706 tons.

Mining Stocks

New York, July 10—On July 5, the Exchange opened dull after the holiday and many of the leading stocks were off. Amalgamated copper declined 2½, American Smelting and Refining Co. 2⅜. The other coppers dealt in on the Exchange were also off several points. On the Curb the copper stocks generally were weaker but with considerable dealings. Cobalt shares were steady and other mining stocks quiet and unchanged.

On July 6, the Exchange was quiet and rather narrow, with very few changes. On the Curb dealings were less active and rather irregular. Coppers were firm on small dealings, while Cobalt shares were weaker. In other mining stocks there were moderate dealings in Tonopah and Yukon Gold.

On July 8, there was heavy selling on the Exchange, with a number of declines. United States Steel weakened on large sales. On the Curb there was activity in spots but on the whole dealings were rather narrow, especially in the copper stocks. Motherlode and El Paso Consolidated were active but at lower prices.

July 9 and 10 the Exchange was irregular with sales lighter, and price changes mixed. The Curb was quieter, mining stocks being in fair demand, with few changes except in copper stocks, which were weaker.

Sales at auction in New York July 3 included the following: United States Reduction & Refining Co., $5000, first mortgage, 6% bonds, 31% of par value; Colorado Fuel & Iron Co., 25 shares preferred stock, $100 par, $110.50 per share.

Boston, July 9—Copper share prices have received quite a setback from the high levels made the latter part of June. The recession has come largely during the last week. The break in London copper warrants today proved an unsettling factor for a brief period, but the June report of the Copper Producers' Association and partial recovery in London offset the earlier effects and copper shares received quite a stimulating effect.

North Butte, which should naturally be the leader, was active and strong today, advancing from a low at $29.50 to $32, with partial setback. Reports are current of favorable underground findings at the property. The Calumet & Hecla subsidiaries also maintain a firmer tone after moderate reactions. Calumet & Hecla broke from a high at $541, its record price of the year, to $515, but quickly came back to $527. Ahmeek made a record price at $370, a few days ago. Superior and Isle Royale also show good support when the market is strong. Butte & Superior, which continues a market leader, broke $4.25 to $43.25, but came back to $45 per share.

Curb trading has been of fair propor-

COPPER SMELTERS' REPORTS.

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	April	May	June
Alaska shipments	1,243,911	1,720,391	4,134,569
Anaconda	25,480,000	25,800,000	.....
Arizona, Ltd	3,400,000	3,500,000	3,300,000
Copper Queen	6,806,425	7,024,087	7,622,733
Calumet & Ariz	4,104,000	4,424,000	4,160,000
Chino	1,150,000	1,275,850	.....
Detroit	2,506,718	2,092,478	1,959,634
East Butte	1,400,000	1,445,000	.....
Mammoth	1,718,450	.....	.....
Mason Valley	1,503,056	1,520,000	.....
Nevada Con	6,115,095	6,063,462	.....
Ohio	675,000	.....	.....
Old Dominion	2,167,000	2,180,000	2,130,000
Ray	2,611,920	2,924,913	2,992,500
Shannon	1,544,000	1,464,000	1,270,000
South Utah	284,215	236,884	.....
United Verde*	2,250,000	2,500,000	.....
Utah Copper Co	8,615,775	9,564,919	.....
Lake Superior*	18,250,000	21,250,000	.....
Non-rep. mines*	7,625,000	8,400,000	.....
Total production	97,400,495	.....	.....
Imports, bars, etc.	26,842,014	25,836,519	.....
Total blister	124,242,509	.....	.....
Imp. in ore & matte	9,350,972	6,410,226	.....
Total American	133,593,481	.....	.....
Miami†	2,554,352	2,565,000	2,584,950
Brit. Col. Cos.:			
British Col. Copper	1,043,173	875,000	996,000
Granby	1,941,797	1,914,460	1,888,400
Mexican Cos.:			
Boleo†	2,149,280	2,280,160	1,851 920
Cananea	4,654,000	4,600,000	4,310 000
Moctezuma	2,797,718	2,892,521	3,176,819
Other Foreign:			
Cape Cop., S. Africa	954,240	754,880	.....
Kyshtim, Russia	1,545,000	.....	.....
Spassky, Russia	649,600	694,400	.....
Famatina, Argen	.....	.....	.....
Tilt Cove, Newf'd	119,869	123,087	.....
Exports from:			
Chile	6,496,000	3,696,000	.....
Australia	9,408,000	7,840,000	.....
Arrivals in Europe‡	12,064,640	9,976,860	.....

†Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	U.S. Refin'y Product'n	Deliveries. Domestic	Deliveries for Export
VI. 1911	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337.753	62,343,901	80,167 904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V	126,737,836	72,702,277	69,485,945
VI	122,315,240	66,146,229	61,449,650

	Visible Stocks		
	United States	Europe	Total
VII, 1911	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,967,557	136,819,200	199,186,757
V	65,966,929	134,176,000	199,242,029
VI	49,615,643	117,801,600	167,417,243
VII	44,335,004	108,186,000	152,521,004

tions and prices have generally followed the trend of the big market. Calaveras rose to $3 on announcement that the company was making small ore shipments. Davis-Daly shows strength and Houghton Copper is fractionally below the recent high.

Assessments

Company	Delinq	Sale	Amt
Best & Belcher, Nev	June 3	June 27	$0.10
Buffalo, Mont.	June 4	July 2	0.002
Challange, Nev.	June 8	July 2	0.10
Chollar, Nev.	July 7	Aug. 5	0.10
Confidence, Nev.	July 15	Aug. 9	0.20½
Crown Point, Nev.	June 24	July 17	0.10
Exchequer, Nev.	May 23	June 13	0.05
Glen Dale, Utah.	May 25	June 25	0.00
Gould & Curry, Nev.	July 19	Aug. 12	0.05
Great Falls, Utah.	June 26	July 27	0.002½
Hale & Norcross, Nev.	July 2	July 29	0.05
Houghton Copper, Mich.	May 17	.....	1.00
Julia, Nev.	May 15	June 5	0.05
Mineral Farm, Ida.	July 15	Aug. 15	0.002
Mineral Hill, Nev.	Aug. 5	Oct. 5	0.01
O. K. Silver Mining, Utah.	July 15	Aug. 1	0.002½
Oreano, Ida.	July 18	Aug. 19	0.001
Overman, Nev.	June 29	July 23	0.10
Savage, Nev.	June 4	June 26	0.10
Seven Troughs, Nev.	June 15	July 2	0.002½
Sierra Nevada, Nev.	July 4	July 30	0.10
Silver Mt., Ida.	July 15	Aug. 15	0.002
Tintic Central, Utah.	June 14	July 6	0.005
Union Consolidated, Nev.	July 12	Aug. 7	0.15
Utah Antimony, Utah	June 1	.....	0.03
Utah, Nev.	July 12	Aug. 6	0.05
Yankee Con., Utah.	.....	.....	0.02
Yellow Jacket, Nev.	July 4	Aug. 12	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	61.290	24.651	24.486	28.215
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385	17.234	12.611	17.443	56.365	78.259
July	12.463	.....	12.720	.....	56.673	.....
August	12.405	.....	12.634	.....	56.266	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	.....
February	41.614	42.962	August	43.319	.....
March	40.157	42.577	September	39.755	.....
April	42.185	43.923	October	41.185	.....
May	43.115	46.053	November	43.125	.....
June	44.606	45.815	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16.509
June	4.435	4.392	4.292	4.321	13.260	17.588
July	4.499	.....	4.397	.....	13.530	.....
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4.356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520	6.877	5.370	6.727	24.612	25.763
July	5.695	.....	5.545	.....	25.006	.....
August	5.953	.....	5.803	.....	26.801	.....
September	5.869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90	15.15	14.06	14.11	14.56	14.22
July	15.90	.....	14.03	.....	14.53	.....
August	15.90	.....	14.00	.....	14.47	.....
September	15.90	.....	13.57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS July 9

Name of Comp.	Bid.
Acacia	.04¾
Cripple Cr'k Con.	.01½
C. K. & N.	.15
Doctor Jack Pot.	.05½
Elkton Con.	.65
El Paso	.92
Findlay	.05
Gold Dollar	.18
Gold Sovereign	.02
Isabella	.13¾
Jack Pot	.04¾
Jennie Sample	.05
Lexington	‡.02
Moon Anchor	.01
Old Gold	.04
Mary McKinney	.70
Pharmacist	.01½
Portland	.93
Vindicator	.80
Work	.01½

SALT LAKE July 9

Name of Comp.	Bid.
Beck Tunnel	.08
Black Jack	.14
Cedar Talisman	.02
Colorado Mining	.17
Columbus Con.	.31½
Crown Point	.02
Daly-Judge	‡5.60
Grand Central	.60
Iron Blossom	1.27½
Little Bell	‡.41
Lower Mammoth	.01¾
Mason Valley	13.25
May Day	.11
Nevada Hills	2.00
New York	.04¾
Prince Con	1.50
Silver King Coal'n	2.75
Sioux Con.	.06½
Uncle Sam	.20
Yankee	.12

TORONTO July 9

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7.10	Hollinger	13.00
Hudson Bay	‡70.00	Imperial	.01
Temiskaming	.37	Pearl Lake	.22
Wettlaufer-Lor.	.55	Porcu. Gold.	.38
Apex	.03	Porcu. Tisdale	.01
Central	‡5.56	Preston E. D.	.03
Crown Chartered	.12	Rea	.25
Dobie	‡.25	Standard	‡.01½
Dome Exten.	.20	Swastika	.11
Foley O'Brien	.12	West Dome	.20

SAN FRANCISCO July 9

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.03	Belmont	9.87½
Belcher	.45	Jim Butler	.61
Best & Belcher	.09	MacNamara	.23
Caledonia	.94	Midway	.51
Challenge Con.	.13	Mont.-Tonopah	2.62½
Chollar	.11	North Star	.15
Confidence	.40	West End Con.	1.80
Con. Virginia	.44	Atlanta	.26
Crown Point	.44	Booth	.08
Gould & Curry	.01	C.O.D. Con	.10
Hale & Norcross.	.19	Comb. Frac	.15
Mexican	2.75	Jumbo Extension	.37
Occidental	.50	Pitts.-Silver Peak	1.00
Ophir	1.00	Silver Pick	.12
Overman	.68	St. Ives	.30
Potosi	.05	Tramp Con.	‡.01
Savage	.12	Argonaut	‡2.00
Sierra Nevada	.20	Bunker Hill	‡4.50
Union Con.	.45	Cent. Eureka	.42
Yellow Jacket	.45	So. Eureka	‡2.90

N. Y. EXCH. July 9

Name of Comp.	Clg.
Amalgamated	81⅛
Am. Agri. Chem.	59⅛
Am.Sm.&Ref.,com	82¾
Am. Sm. & Ref., pf.	108
Am. Sm. Sec., pf. B	87⅝
Anaconda	40⅛
Batopilas Min.	1⅛
BethlehemSteelpf	68¼
Chino	31¼
Comstock Tunnel	‡.12
Federal M. &S., pf.	43⅛
Goldfield Con.	4⅞
GreatNor.,ore.,ctf.	43½
Guggen. Exp.	55¼
Homestake	95
Inspiration Con.	18⅛
Miami Copper	28
Nat'naiLead,com.	57¾
National Lead, pf.	107½
Nev. Consol.	20⅝
Pittsburg Coal, pf.	93¼
Ray Con.	20⅝
Republic I&S,com.	26¼
Republic I & S, pf.	85
SlossSheffi'd,com.	55
Sloss Sheffield, pf.	100
Tennessee Copper	44⅜
Utah Copper	60¾
U. S. Steel, com	68⅝
U. S. Steel, pf.	111⅞
Va. Car. Chem.	48⅝

N. Y. CURB July 9

Name of Comp.	Clg.
Barnes King	.30
Beaver Con.	.44
Braden Copper	7
B. C. Copper	5⅛
Buffalo Mines	‡1.40
Caledonia	.40
Con. Ariz. Sm.	⅜
Davis-Daly	2⅛
Diam'field-Daisy	9
Ely Con.	7/32
Florence	1⅛
Giroux	5
Gold Hill Con.	2/16
Greene Cananea	9¾
Greenwater	.05
Internat. S. & R.	124
Kerr Lake	2⅞
Keystone	2⅜
La Rose	3½
McKinley-Dar-Sa.	1 11/16
Min Co. of A. new	3
Motherlode Gold.	1
Nev. Utah M. & S.	03½
Nipissing Mines	7⅝
Ohio Copper	1/16
Pacific Sm. & M.	3/32
South Live Oak	3⅝
South Utah M. & S.	¾
Standard Oil (Old)	865
Stand'd Oil of N.J.	392
Stand'd Oil Subs.	525
Stewart	1/32
Tonopah	6⅝
Tonopah Ex.	2
Tri-Bullion	1/16
Tularosa	‡1½
Union Mines	1/16
United Cop., pfd.	10
Yukon Gold	3⅜

LONDON July 10

Name of Com.	Clg.
Camp Bird	£1 8s 6d
Dolores	1 10 0
El Oro	0 16 0
Esperanza	1 10 0
Mexico Mines	7 0 0
Oroville	0 5 9
Stratton'sInd.	0 3 1½
Tomboy	1 6 6

BOSTON EXCH. July 9

Name of Comp.	Clg.
Adventure	8¼
Ahmeek	355
Algomah	5¾
Allouez	44⅞
Am. Zinc	30½
Ariz. Com., ctfs.	5¼
Bonanza	.40
Boston & Corbin	7⅜
Butte & Balak	‡3½
Calumet & Ariz	74⅜
Calumet & Hecla	526
Centennial	24
Con. Mercur	‡.05
Copper Range	57⅛
Daly West	5½
East Butte	13¼
Franklin	11
Granby	53
Hancock	31½
Hedley Gold	17
Helvetia	1⅛
Indiana	16¾
Island Cr'k, com.	61
Island Cr'k, pfd.	88
Isle Royale	34
Keweenaw	1⅜
Lake	35⅛
La Salle	6⅜
Mass	7
Michigan	3
Mohawk	69
New Arcadian	3¾
New Idria Quick.	6⅞
North Butte	31
North Lake	6
Ojibway	4⅛
Old Dominion	57
Osceola	115
Quincy	91
Shannon	15½
Shattuck-Ariz.	21⅜
Superior	44⅛
Superior & Bost.	2
Tamarack	41
Trinity	6
Tuolumne	3¾
U. S. Smelting	45¾
U. S. Smelt'g, pf.	50
Utah Apex	2¾
Utah Con.	10
Victoria	3⅛
Winona	5⅞
Wolverine	110
Wyandot	2

BOSTON CURB July 9

Name of Comp.	Last
Bingham Mines	4½
Boston Ely	1
Boswyocolo	.02½
Butte Central	6½
Cactus	.10
Calaveras	2⅞
Chief Cons	1⅝
Corbin	.99
Cortez	1
Crown Reserve	3½
First Nat. Cop.	1⅝
Majestic	.48
Mazatan	‡½
Moneta Porc.	‡.07
Nevada-Douglas.	3½
New Baltic	2
Oneco	2½
Raven Copper	.27
Rhode Island Coal	.32
San Antonio	‡3
S. W. Miami	5½
South Lake	8½
Trethewey	.40
United Verde Ext.	.30
Vulture	‡5.00

‡Last quotation.